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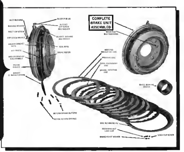
An important message about LANDING GEAR to designers of larger, faster ships



GOODYEAR HYDRAULIC DISC TYPE 15.00-16 AIRPLANE BRAKE —*disassembled* Greater braking power without increase in brake and wheel diameter can be obtained by increasing number of discs in brake housing.

As ships increase in size and speed the need for greater braking power brings up important considerations in size and weight of wheel assembly, and in housing facilities for landing gear when retracted!

In conventional wheel assemblies where braking power is in direct ratio to brake drum area the only way to step up brake capacity is to employ a larger and heavier drum, with a corresponding increase in wheel and tire size that requires larger housing space.

GOODYEAR AIRPLANE TIRE, TUBE AND WHEEL ASSEMBLY WITH HYDRAULIC DISC BRAKE — tire, tube and wheel shown mounted on axle, ready to slide into position on the brake

Fortunately, there is a better solution. Brake capacity can now be increased to meet any load and speed requirement with relatively little growth in wheel and tire size by the use of a complete Goodyear wheel assembly—Goodyear magnesium or aluminum alloy wheels, Goodyear hydraulic disc brakes and Goodyear tires, including Airwheels*.

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Our engineers will be glad to cooperate with you in incorporating the advantages of this time-proved wheel equipment in your new ships—in both conventional and tricycle gear. Just write Goodyear, Aeronautics Department, Akron, Ohio, or Los Angeles, California.

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ON YOUR NEW SHIP SPECIFY GOODYEAR AIRPLANE TIRES AND BRAKES

The New "105" Really Started Something!

Since 1925 we have been building fine planes which hold an unexcelled reputation for quality and safety. Yet always we planned toward the day when we could produce an equally fine plane of outstanding beauty and superior safety at a price thousands could afford.

In the Stinson "105" we sincerely believe we have created such a plane. Yet it is priced at only $2995.00*. It operates for less than 2c per passenger mile. It cruises at 105 MPH. It has beauty and safety features unsurpassed regardless of price.

We believe in and expect great things of the "105". Yet we are amazed at more than $225,000.00 worth of orders and commitments received before the "105" was publicly displayed. We are deeply grateful for this expression of confidence.

A fleet of "105" Demonstrators is now on tour. Deliveries are rapidly being made to all parts of the Country. Won't you inspect and fly the "105" if you plan to buy a fine airplane this year. Convince yourself that all we say about the "105" is true.

*Including Federal taxes, not including state or local taxes.

The experience gained in manufacturing the Stinson Reliant makes it possible to present at a popular price, such a fine airplane as the "105". Pictured above, is the new Reliant for 1939. You'll like it even better than you did its predecessors, because of the 25 new improvements in functional design, beauty, and comfort.

P.S. Rumors that it will be impossible to secure deliveries of the "105" for several months are without foundation. It is true we found a buying response beyond our original estimates. But experienced personnel and extra shifts have been added. Production will be at peak during June. Customers tell us they have waited all these years for a plane with all the fine qualities of the "105". Won't you bear with us if demand for the "105" makes a few extra days' waiting necessary? Thank you!

Free! Write for your copy of Stinson Plane News. Just off the press, this 8 page illustrated publication is filled with pictures and information about the new Stinson planes.

STINSON AIRCRAFT DIVISION

AVIATION MANUFACTURING CORPORATION • WAYNE, MICHIGAN, U. S. A.

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THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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A McGRAW-HILL PUBLICATION

Flashes

Picked Up Along Editorial Airways

» CENTER OF ATTENTION this month lies in the hills and valleys up-State New York around the little city of Elmira. Last year's Soaring Meet was exceptionally good and all signs point to far better performance this year. It is known that close to 100 new designs have been turned out and it seems likely that the largest list of starters yet will be ready to take off at least by the 4th of July weekend; the second of the three weekends of the meet. We may confidently expect American and possibly world's records to fall before the big show is over.

» AVIATION IS FORTUNATE in being able to give its readers at this time a detailed report on the latest in gliding and soaring machines and technique from Europe's great soaring camps.

Mr. Maurice Garbell who wrote the lead article this month, has not only been a student in German and Italian camps, but was an instructor in one of the largest Italian soaring centers. He is also a designer of considerable repute, having at least two successful soaring machines to his credit, and is therefore more than competent to discuss the latest developments in European soaring technique. With two exceptions all the photographs used with his article were taken by him during last year's contests abroad.

» THE FIRST $50,000,000 has been allocated and orders placed for the beginning of America's aerial re-armament program. Elsewhere in this issue details of the orders are given, but it is safe to say generally that never before have America's air forces had available to them machines of such outstanding performance as will be bought under the new program. Europe's designers have a two or three years' head start and have been setting remarkable records of performance in the past few weeks, but Americans can rest assured that our industry and our engineers are producing for our defense machines which cannot be topped for the purposes for which they are intended. It was our privilege only last week to visit the plant of the Allison Engineering Company, a concern which figures prominently in the new orders. And although much that was seen must of necessity be off-the-record, we can assure our readers that important progress is being made in the development of liquid-cooled engines to supplement the remarkable radial air-cooled types that have kept our commercial and our fighting planes to the fore in design and performance.

» THE QUESTION OF CAPACITY to produce aircraft and engines for our present rearmament programs has been agitating government and industrial circles for the past few months. Few people could be more competent to analyze the problem and to produce a satisfactory answer than Curtiss-Wright's engineering director, T. P. Wright. We are inclined to think that when the score is added up, Mr. Wright's story in this issue, "America's Answer," will prove to be the story of the year and will furnish a guide for the entire aviation industry in making its plans for expansion during the next twelve months. It was our privilege to listen to Mr. Wright's lecture on American production methods in London in November, 1938, and we feel sure that the analysis that he has made for AVIATION's readers will be read all over the world.

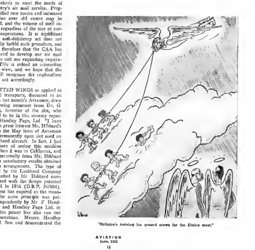
» $1,000,000 CUT in the appropriation for domestic air mail for the fiscal year 1940 is perhaps not quite as bad as it looks. Indications are that the Committee did not throw out that sum with the intent to hamper the development of aviation, but it hinted that under the present law the CAA has the power to grant certificates for additional groups and extensions as required, and can obtain the neces-

sary funds to carry forward such a program under future deficiency appropriations. There is plenty of precedence under rulings of the courts and the Attorney General to demonstrate that the Postmaster General is not bound by the amount of current appropriations to meet the needs of the country's air mail service. Properly certified new routes and increased frequencies over old routes may be instituted, and the volume of mail increased, regardless of the size of current appropriations. It is significant that the anti-deficiency act does not specifically forbid such procedure, and it seems therefore that the CAA has a free hand to develop our air mail service to suit our expanding requirements. This is indeed an interesting point of view, and we hope that the CAA will recognize the implications and will act accordingly.

» SLOTTED WINGS as applied to Lockheed transports, discussed in an article in last month's AVIATION, drew the following comment from Dr. G. Lachman, inventor of the slot, who happened to be in this country representing Handley Page, Ltd. "I have read with great interest Mr. Hibbard's article in the May issue of AVIATION on the permanently open slot used on the Lockheed aircraft. In fact, I had the pleasure of seeing this machine myself when I was in California, and to hear personally from Mr. Hibbard about the satisfactory results obtained with this arrangement. The type of slot used by the Lockheed Company and described by Mr. Hibbard complies indeed with the design patented by myself in 1918 (D.R.P. 347884). This patent has expired in the meantime. The same principle was patented independently by Mr. F. Handley Page and Handley Page Ltd. in 1919. This patent has also run out in the meantime. Messrs. Handley Page Ltd. flew and demonstrated the first aeroplane ever fitted with fixed, i.e., permanently open slots, in 1920."

» MAINTENANCE will be the theme of next month's issue. Proper maintenance of aircraft on the air lines, in the services, and for private owners is one of the most important elements in flight safety. AVIATION has long cooperated with the Maintenance Committee of the air lines and with maintenance heads of the services, and the July issue will be devoted to the work of maintenance personnel in all branches of aviation. One of the outstanding features will be an enlarged maintenance note-book, which will present the finest and most extensive collection of maintenance ideas that has ever been put together anywhere. The issue will also contain the announcement of AVIATION's Maintenance Award for the calendar year 1938.

GOODWILL AMBASSADORS to aeronautical Europe from aeronautical America are Dr. George Lewis and Major Lester Gardner. As we go to press they are on the high seas on the SS "Washington", and will probably make a fairly extensive cruise in Europe before returning. Dr. Lewis is scheduled to deliver the Wilbur Wright Memorial Lecture at the annual meeting of the Royal Aeronautical Society. Major Gardner will attend the meeting to receive the honorary fellowship which has been awarded him. They will extend invitations to aviation officials of foreign governments to attend the Institute's International Congress of the Aeronautical Sciences scheduled for New York in September. We should all feel great satisfaction in knowing that aviation in America is being represented abroad by two such distinguished travellers as Dr. Lewis and Major Gardner.



"McGuire's training his ground crews for the Elmira meet."

Side Slips

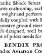
By
ROBERT OSBORN

Random Notes on the N. A. C. A. Conference

» Ed Warner, former Editor of the World's Best Aeronautical Magazine (*Advt*), now C.A.A. Board member, on hand as usual complete with dignified manner, gifted tongue, and the remarkable watch which has, in addition to the usual works, two stop-watch hands, barometer, compass, and chimes which ring out the quarter hours.

» Ted Wright, of Curtiss-Wright, who always has the largest sheaf of notes on the latest N.A.C.A. developments, and who actually writes them up in a report when he gets back home. Each year Ted also successfully defends the championship for having the wildest pajamas on the boat

» Lindbergh, completely relaxed and enjoying a trip with a crowd speaking the same language Even the waitresses in the Chamberlin Hotel



at Old Point didn't recognize him, not expecting him to be with a bunch of Visiting Firemen on convention

» As there were a number of Senators and Congressmen along, the rainy and cold weather, which occurred for the first time on any N.A.C.A. tour, was generally taken to be additional lobbying for the Sunnyvale, California laboratory appropriation

» Hollerith and Cautley, the demon wheel salesmen, off in a corner together deploring the present trend toward large flying boats in the Navy.

» Dick Depew comparing notes with Bob Earle to determine how many Taylorcrafts would have to be traded in to get one Curtiss-Wright electric controllable propeller.

» Note to the Chief Engineer of the Norfolk and Washington Line: The Steamer "District of Columbia" is either running rough on one magneto or has a tendency toward tail flutter

» Dr Bush did a very able job of substituting for Dr Ames in the opening session at the Post Theatre. However, everybody missed Dr Ames very much and especially noted the absence of his regular greeting to the crowd at the beginning of each annual session,—"Will you kindly *sit down!*"

» Rush Child looking for the fellow who gave out the statement to the newspapers that his brother couldn't have dived that pursuit to 600 miles per hour.

» Interesting side-light on Human Nature The slot machines being played enthusiastically by the mathematical experts who know the probabilities against them better than the average man.

» John F. Victory, Secretary of the N.A.C.A., running around wearing his annual worried look

» Casey Jones hoping the weather would be bad enough on the way back that he could sell the Line a Link Trainer for its pilots

» The story-telling abilities of "Deak" Lyman and "C.B." Allen fortunately not affected by their shifts from newspaper work to United Aircraft and C.A.A. respectively

Speaking of Deak Lyman reminds us that he has reported the loss without a trace of his famous black hat, which is sad, sad news for the Aviation world This hat, which he found under a seat in the stadium after the Dempsey-Tunney fight in Philadelphia, never felt the touch of brush or cleaning fluid in all the years that Deak wore it, and was thus kept in condition for bringing him luck (and a Pulitzer Prize) That hat definitely marked the beginning of an era for Aviation, and deserved to end its

days peacefully resting in a moth-proof case at the Smithsonian Institution

» Frank Russell and Sumner Ireland, the back-to-the-landers whose Pennsylvania farms adjoin the Charles Sherman Jones estate, discussing cattle feeds and disc harrows in the midst of lift coefficients and high-density tunnels

» All of the salesmen automatically handing out sales talk to all of the other salesmen.

» Commander Walter Diehl on the alert for new stories to add to his already remarkable collection

» Now that present and future superiority in the air has become such an all-important consideration in international affairs, we are wondering if the course of history might not have been changed if the humorless dictators of Europe could have listened to the stories that were told and the songs that were sung, by America's aviation experts in the staterooms on the old District of Columbia.

AVIATION *for June, 1939*

The "Rheinland," with a trans-Alpine flight to its credit

1938 Italian champion, "ARCORE." Note spoilers

European

(Photos by author unless otherwise indicated.)

WINGS on the Wind

Remarkable progress in gliding and soaring in Europe is disclosed in this report on design and technique in Germany and Italy.

By Maurice A. Garbell

Member of International Research Committee for Motorless Flight

Over the Alps and across the English Channel—distance records of over 400 miles, altitude records of 30,000 ft., over 51 hours in the air on a single flight—such are the marks set by European soaring pilots in the past year. Constant research and continuous refinement in design have yielded astounding results. And the work still goes on to develop new sailplanes with high speed range at low sinking speed, machines of good maneuverability, combined with comfort, safety and unimpaired vision for the pilot.

Speed range is important because the sailplane needs the ability to fly slowly when circling in thermal currents and within cumulus clouds, and at the same time high speed is required for flying under "roads of clouds" and for crossing down currents quickly. However, the speed range should not be improved at the expense of the sinking speed. It has been good practice until recently to employ wing sections with good power factor (such as the Göttingen 535) with increasing wing loading in order to obtain higher speeds. This of course has been accomplished at the expense of minimum sinking speeds and ships which were able to fly considerable distances in exceptionally favorable weather conditions were unable to soar when thermal conditions were poor. As it is obviously impossible to build special ships for each meteorological condition, sailplane constructors abroad have sought the same results by using wing sections with lower lift

A Horten tailless type. See following pages for details

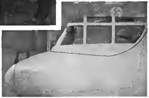
The 38 ft. German sailplane "Kolibri." Wing and nose in one piece, fuselage in two

Left: A simple means to secure good pilot vision on the German C-11.

Below Wing root of the Jacobs Reiher,

Left: Nose treatment of the Horten tailless

Below. This enclosure on the Condor is quickly detachable for safety



Below. Hungarian built Nemere approaches ideal streamline shape

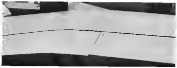
coefficients, but with better characteristics at high speed and by getting a reasonable sinking speed with a low wing loading (about 3.3 lb per sq ft) For example, the German builder, Jacobs, has recently been using the Gottingen G549 section while other designers have been using such sections as the NACA 23012, 43012, 2412, 2415, 2418, 4412, 4415, 4418, etc

The Jacobs sailplanes *Reiher*, *Weihe*, and *Meise* have been very successful in the last International and German meets The first two ships are of 60-ft span with moderately tapered wings The G 549 section is used over the central 60 per cent of the span, with G 676 sections for the wing tip panels These wings are extremely interesting because they are of a fully cantilevered type with a thickness factor (maximum ordinate at the wing root to span) of only 0.01 This was accomplished by using a beech plywood of 100 plies to the inch for the main spar

Reiher has a central gull type wing while *Weihe* and *Meise* (50 ft. span) have high straight wings *Reiher* also has flaps over the entire wing span to decrease the sinking speed when flying in weak thermals Since its gliding angle is approximately 32 to 1, it has been necessary to provide four large spoilers to make it possible to land in reasonably small fields.

Jacobs made a reasonable compromise in favor of maneuverability by giving the wings of his ship a washout of 7 deg between wing root

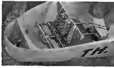
Above: Wing of German B-8 with slotted flap and aileron.

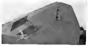


Above left. Wing support fairing of the *Condor IIa*.

Above: Sub-divided flap at bend in wing of Jacobs Reiher

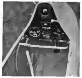
and wing tip, incidentally, the washout is maintained also when the flaps are lowered The degree of washout, of course, depends not only on how much aerodynamical efficiency the designer is ready to sacrifice to obtain improvement in lateral control but also upon safety considerations A modern sailplane may easily reach a speed of between 100 and 150 m p h flying blind in a storm cloud and obviously such speed with big washouts may be dangerous because of the strong negative couple set up at the wing tip One solution to this problem has been found in the application of self-stabilizing spoilers Such spoilers act not only as aerodynamic



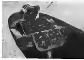


Above: Adjustable rudder pedals on the *Rheinland*.

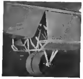
Above. Typical slot-spoiler installation.



Right: Two compact instrument groupings.



Below: Two retractable gears Left. Horten; right. the German Mo type.



Below: Wing root treatment of the *Rheinland*. Wheel retracted.

Below: Detail of retractable wheel on *Rheinland*.

brakes to prevent the sailplane from exceeding a certain speed (for example 120 m p h), but they also have a stabilizing effect keeping the plane somewhat below safe speed more or less automatically without the necessity of elevator control on the part of the pilot.

The extreme conditions of temperature and humidity under which modern sailplanes fly raises a number of problems, among them the efficiency of the control Control cables change in length under temperature differences and also ice formation on the controls themselves introduces flying difficulties Rigid types of control connections compensated for temperature have reduced the difficulty in the first case, and the ice formation problem has been partially

A German trailer with chassis of a control tube light steel framework and two independent wheels. Wooden frame and heavy canvas cover protect against wind and rain.

Rear closure for above trailer.

solved by keeping control connections completely inside wings and fuselages. Actual blocking of controls through ice formation has occurred, and occasionally a thin layer of ice on the wings has prevented movements of ailerons

Most designers attempt to eliminate the old defect of all sailplanes, that is the elevator more sensitive than the ailerons and the ailerons more sensitive than the rudder. Actually, the differences are very small and the controls on a modern sailplane are practically harmonized as far as sensitivity is concerned. All rudders are now statically and dynamically balanced because the sudden accelerations which sometimes occur in cloud soaring might otherwise induce vibrations and stresses which would be destructive. Small flaps are frequently used on elevators and on ailerons to provide aerodynamic compensation

A GREAT DEAL of thought has been put on the selection of materials for sailplanes in Europe, partially to select materials with outstanding characteristics and partly to compensate for the lack of certain materials. Most of the ships are still built with skeleton of spruce or pine and covered with birch plywood. As mentioned previously, beech plywood of very thin lamination is sometimes used for highly stressed wing spars. Metal wings such as those built by the Schweitzer brothers in this country are almost completely unknown. Generally, wood is the accepted wing material. In the case of the Darmstadt D-30 sailplane however, no wood was found that was capable of handling the stresses set up in a wing with an aspect ratio of 1 to 33 and in that case the wing spar was made of Elektron (a magnesium alloy) which has a specific weight of about 1 8

Another ship, the Berlin B-6, is quite remarkable as far as design and materials are concerned. The wing is the NACA section 43012 (Section 23012 with the camber changed from 2 per cent to 4 per cent) with a slotted flap of the original 23012 section. The wings are wooden monospar type but the flaps and ailerons have a wooden framework with Bakelite covering

The fuselage is in two parts with a nose section made of steel tube with fabric covering, and with the tail made up of a framework of wooden tubes covered with Bakelite impregnated paper

CONSIDERABLE attention has been given to the design of tailless soaring machines in order to reduce the overall drag by eliminating the fuselage. The aerodynamical efficiency as a sailplane suffered, however because a large part of the wing must be sacrificed for stabilization and for control

Although tailless sailplanes have been in use for over ten years, they are thought to have insufficient aerodynamical qualities for thermal soaring During the last two Rhön contests, however, this opinion has been changed by the performance of three Horten tailless machines whose behavior came quite close to that of normal ships One such machine flew 150 miles and another one attained an altitude of 15,000 ft The Horten machines have very highly tapered wings with the pilot's seat, the controls and a partially retractable landing gear located in the fixed central section In some of the "Horten's" there is a metal construction in the center, but wings are of wood of normal construction, flaps and ailerons are unusually large, and four large spoilers without slots take the place of the ordinary rudder by acting as brakes on the inside wing in turns

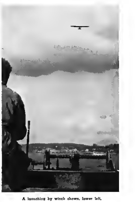
SENSITIVE and safe instruments are highly important and the three most valuable, the variometer, the air speed indicator and the turn indicator have been subject to continuous improvement. Considerable confusion exists, especially about variometers, as the terms sensitiveness, promptness and precision are generally assumed to be synonymous Actually *sensitiveness* is the indication of a very small change in vertical speed, for example, the capacity to indicate a passage from a sinking speed of 3 ft. 4 in per second to one of 3 ft 10 in per second *Promptness*, on the other hand, is defined as the time required to indicate a given variation of vertical speed For example, if the sailplane is gliding at a sinking speed of 2 ft. per second and enters an up-current which produces a resulting climbing speed of 3 ft per second, a variometer is "prompt" which changes from —2 to +3 ft per second reading in about 1 second and not in the 10 to 15 seconds usually required for rate of climb indicators on powered airplanes Finally, *precision* depends upon the minimum of variations between the indication of the variometer and the actual vertical speed. Although a sensitive variometer is generally also precise (and vice versa), precision and promptness are two different things which so far have not been combined successfully in the same instrument.

A considerable amount of work has been put on the two types of variometers Precision types are generally based on the holosteric membrane system which gives a maximum reliability but is not particularly prompt because of the comparatively large forces and quantities of air which are necessary to move the membrane. The two most successful "prompt" variometers have

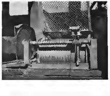
(*Turn to page 76*)

Typical German trailers ready for the road.

Left: An interesting Italian portable workshop for soaring meet use Note folding work bench and tool kit.



A launching by winch shown, lower left.



An Italian winch mounted on open Auburn frame

Milan type winch, mounted inside touring car, as described p. 78.

Pilots by the THOUSANDS

By Oliver L. Parks

President, Parks Air College, Inc.

The prospect of doubling the existing number of pilots within a year has created many training problems. Steps are now being taken by the C.A.A. to provide solutions for those now foreseen and for those which will be revealed in the course of the experimental program now under way.

We asked Mr. Parks recently to comment on the situation as he saw it. His views are particularly valuable since his experience includes operation of a large residence school, as well as a smaller one of the type now being used in the C.A.A. Civilian Training Program.

The remarkably efficient and dependable service that the airlines have been giving, together with the Munich Conference and subsequent events in Europe, have focused public attention on aviation as never before, and most of this attention is favorable. The significance of this modern method of transportation, both in our peace-time economy and in defense, is rapidly penetrating the national consciousness.

An immediate and tremendously important result of the newly awakened widespread interest in aviation is that our administration leaders and Congress have proposed and secured favorable action on plans for the acceleration of aviation's development. The plans which most directly effect those of us who have devoted our energies and resources for a number of years to the development of aviation schools and securing for them both official and unofficial approval, have to do with the training of aviation personnel.

The question inevitably arises in our minds as to what will be the position of our schools in the rapid march of personnel training events. Will they be in positions of leadership? Will they be somewhere back in the procession? Or will they be shunted out of the line of march altogether?

Taking for granted the ability and desire of those in authority to avoid injustice, and, in order to avoid waste, to utilize as fully as possible existing physical and human resources, we can conclude that the answer depends, in part at least, upon the ability of the schools themselves to provide training of the character and in the volume required.

As is well understood, at least within the industry, four plans for personnel training are underway or are proposed. The first, the Civil Aeronautics Authority plan to provide flight training up to the Private Pilot stage for 330 selected applicants in 13 designated colleges and universities, is passing the halfway mark at the time this is written. By the latter half of June it should be completed, tabulations made, and the lessons to be learned from this trial effort available as guides for future planning.

At the present time, however, I can venture the opinion that one of the lessons that will be emphasized is that the success of any training venture is directly dependent upon the calibre of the instructing talent. It will be emphasized that in aviation, as in any other field, skill in teaching is required. Just as a famous athlete may be a failure as a coach, so a capable pilot may not be altogether successful as an instructor. Charter service, airline piloting and military flying are all valuable, but to any background must be added the necessary patience and instructing technique if the flight instructor is to do satisfactory work.

Another lesson that this preliminary training experience can be expected to teach is that sound business principles can be observed to advantage in a pilot training program as elsewhere. For example, we want and must have capable instructors, and we should expect to pay for their services a sum adequate to maintain their interest in their work and hold them. If we don't have to pay it, we should pay it anyhow just to avoid demoralizing and bogging down the whole program later on. And sound business principles dictate that salaries be paid out of income and not out of capital.

But there are other items to be paid out of income. In most states the law requires—and in all states good business principles require—that workmen's compensation insurance be carried. Then there are other forms of insurance to be carried, equipment to be maintained, depreciation to be written off, taxes to be paid, incidentals to be taken care of, a reserve-for-contingencies fund to be set aside and a return to be made on invested capital, all out of income. To operate otherwise is to operate on a shoestring and to violate sound business principles, and we can all agree that the "shoestring" era in aviation has continued long enough.

When all the records of this initial program are in, I am convinced an impartial examination of them will show that a maximum of $250 for a maximum of 50 hours primary flight training is not enough to permit the contractor to observe sound business principles. Since in aviation it is never wise to purchase quantity at the expense of quality, the answer is adequate pay, say $8.00 an hour, even though the total hours of training is less.

Whatever the lessons learned, they should be decidedly helpful in charting the course of the second plan, that of providing training for as many as fifteen or even twenty thousand young men annually. Obviously proven training practices and uniformally high standards will need to be maintained if for no other reason than that the law of gravity is still operative and a series of accidents would surely do much to destroy the public acceptance of aviation that has so patiently been built up. The maintenance of standards is a comparatively simple matter provided the flight instructors measure up to an established minimum requirement. It is here that flight schools which have been designated by the Authority can cooperate effectively by giving to instructors who would participate a course of preparation training that had been outlined in complete detail by the Authority. The success of the entire program would be further assured if each instructor were given three weeks additional training by the Army Air Corps at Randolph Field. Since one objective is to create a reservoir from which piloting material can be drawn readily in case of national emergency, it is possible that provision can be made for the military training.

Just what part, if any, commercial aviation schools will be asked to play in the third and fourth plans, those of greatly increasing the flight and mechanic personnel of the Army Air Corps, I do not know. Probably details will be revealed before this is printed. Without doubt, any school called upon will gladly cooperate to the fullest extent possible, making available its resources as may be required.

Such cooperation must needs be of value to the Army Air Corps—otherwise, there would be no reason for entering into it—and in two ways it may be of value to the schools. The first way and the most obvious is the financial. If the payments for training given are sufficiently large, the school can improve its equipment and strengthen its financial position. The second way is of equally great or greater importance. Through association with officials of the Air Corps and familiarization with standards maintained and the training methods used, the school can supplement the experience already gained and so measurably improve its training service.

I am firmly convinced, however, that it would be a mistake for any school to think of participation in the Air Corps program as an end in itself. I realize that events may alter this opinion, but the point I want to emphasize is that in preparing young men for useful careers in commercial aviation, the commercial aviation schools have a job worthy of their best efforts and, because the industry has possibilities for almost limitless expansion, one that will keep them occupied for many years.

In all the confusion of events, reports and counter-reports, I am convinced there has appeared no reason why aviation schools bent on doing a constructive educational job should alter their long time objective. Cooperation in carrying out Federally sponsored plans for personnel training may require considerable readjustment in the administration of school affairs, but instead of interrupting, this cooperation should accelerate the school's program for improvement and development.

America's Answer

Gearing Our Aviation Industry to the National Defense

Here is the Story of the Year, the answer to the question, "Can we do the job proposed by the President?"—written by a man who is recognized at home and abroad as outstanding authority in the field of design and production.

By T. P. Wright
Director of Engineering Curtiss-Wright Corporation

LAST January the President recommended to Congress the enactment of legislation for increasing our air forces to provide national defense in the air commensurate with our need. Essentially, these plans contemplate an Army air force of 6,000 planes and a Naval air force of 3,000 planes, such strength to be secured in not over two years' time. Such a program immediately raises the question: Can the Aircraft Industry do the Job? More specifically, can it do it and still meet export market delivery obligations and transport market requirements? It is a major purpose of this article to investigate thoroughly the factors involved so as to arrive at an answer to this question.

There have been many visitors from the American aircraft industry to Europe during the past several years, quite a number of whom have been privileged, as was I, to inspect aircraft factories in several countries. This has resulted in the "game" of estimating airplane production in these countries. The results have sometimes varied quite widely. Because of the secrecy generally attached to aircraft production figures, it is usually difficult to obtain reliable data on current deliveries. However, it is quite frequently possible to obtain information on the number of persons working at a given factory, from which fairly reliable estimates of probable production are possible. My own rough formula, used during my trips to Europe, was the following: 1,000 men on the direct labor force could produce 10 airplanes a month of a type having a gross weight of 10,000 pounds. The results of applying this formula proved quite good when check against actual output could be made. It showed somewhat greater efficiency for the United States than for most countries abroad. Other estimates which have been based on factory floor area, however, are believed to be less reliable unless data on the number of shifts of men working is also available. It is apparent, however, that by combining these factors, an accurate estimate of output, assuming equal efficiencies, is possible. This estimate can be even more precise if a breakdown of gross weight into component weights is available. Production deliveries are assumed to be inversely proportional to weight of airplane produced.

It is necessary, however, to have a general idea of the quantities which are being produced under each given order as output per man is proportional to a factor related to the quantity under order. It is interesting to note in our own country how such quantities have increased in recent years. Whereas in 1935 the average Army order was for about 30 planes, this figure rose to 50 in 1936, to 100 in 1938 and, it is estimated, will be of the order of 300 during the next two years. Amounts for corresponding years for the Navy are 35, 60, 75 and 125.

The basic scheme proposed in this article is to determine actual outputs from plants operating at approximately one-shift capacity at the present time and then to extend these figures to cover the whole industry, first on a one-shift basis and then to total capacity, properly "weighting" for such factors as quantity and type of construction. Statements issued by the Aeronautical Chamber of Commerce and by military authorities have dealt with this subject in general terms but it has seemed desirable that a detailed analysis be made. This can best be done by the use of a number of tables and these are included in this article for the purpose of arriving at an answer to this basic problem: Can We Do The Job?

One fundamental assumption made is that our expansion is aimed at taking care of the present announced program and does not contemplate substantial variations therefrom. Naturally, it is also assumed that there will be no major war as, in such event, "all bets are off." Basic production information and data on the size of the industry is as of May 1st, 1939. It has also been assumed that the major production period during which the proposed expansion program will be carried out will be from July 1st, 1939 to July 1st, 1941. Account is taken of current orders for the export market, the existence of which incidentally, fits in very nicely with the present moderate expansion of the industry in the sense that it efficiently prepares it for subsequent orders to meet the expansion program or our own air forces. Assumption is made that there will be no major labor trouble to retard production and, in addition, that there will be no major failures in airplane types after being put into production, necessitating important changes "in mid-stream." As these factors are indeterminate and, unfortunately, may enter in, to a greater or less extent, it is obvious that in order to meet its program,

Table 1

Production Possibilities

One-Shift and Capacity

Item	Labor Force (Direct): Day	Night	Third Shift	Totals	Mf'g Area: Floor Space Square Feet	Sq. Ft. per Man	Product: Average Size (lb. Struct.)	Deliveries per Month: Money Value: Total	Unit $/Lb	Quantity No.	Dollars per Sq. Ft: Per Month	Per Year
Airplanes												
Actual (One Shift)	2,200	600	—	2,800	500 000	179	2,700	$1 340 000 @	$6 00	81	$2 68	$32 35
Capacity (with 10% floor space expansion)	2 500	1 500	1 000	5,000	550 000	110	2,750	2 490,000 @	7 40	122	4 52	54 15
Engines												
Actual (One Shift)	1,800	800	400	3 400	900 300	660	1 260	2,530,000 @	7 60	270	2 81	34 80
Capacity (with 10% floor space expansion and some subcontracting)	2 300	1 400	800	4 500 (Incl. added subcontracting)	1 000 000	222	1 260	3 830 000 @	7 50	805	3 83	46 00
Propellers												
Actual	(Large Percent Subcontracted at Present)						340	390 000 @	7 90	83	—	—
Expanded							380	*799,900 @	7 60	275	—	

*Note: The Unit Cost of Propellers in Dollars Per Pound is so nearly equal to the value for Engines that in subsequent computations the Engine and Propeller will be considered as a Unit by suitably adjusting engine weights to include weight of propeller.

Table 2

Size of U. S. Aircraft Industry

Present and Expanded

	Floor Area (sq. ft.)	Labor Force (Direct)	Sq. Feet Per Man
14 Major Companies Producing Military and Transport Airplanes —			
Present Actual	6 091 000	33 500	184
Capacity (10% Floor Space Expansion and 84% Personnel Increase)	6 700 000	60 700	110
8 Companies Producing Commercial Airplanes (but not Light Planes)	500 000	1 000	300
15 Other Companies Producing Light Planes for the most part	300 000	1 000	300
4 Major Companies Producing Military and Transport Engines	1 600 000	7 000	228
4 Major Companies Producing Military and Transport Propellers or Blades therefor	405 000	1 500	270
Total Actual — Engines & Propellers	2 310 000	9 000	256
Capacity " " " (10% Floor Space Expansion and 35% Personnel Increase)	2 880 000	13 100	222
— Major Companies Producing Accessories for Military and Transport Airplanes including Instruments and Parts		5 000	

Table 3

Government Cost of Maintaining a Fixed Size of Air Force

(Testimony at Hearings before the Sub-Committee on Appropriations, U. S. House of Representatives — Appropriation Bill 1939)

Replacements due to Crashes and Obsolescence, to Maintain a Force of 2,320 Airplanes

Airplane Type	Number	Percent	
Pursuit	126	24 4	
Bombardment	107	20 7	61 2
Attack	83	16 1	
Observation —			
Corps and Army	25	4 8	
Long Range	14	2 7	
Amphibian	7	1 4	13 3
Cargo	23	4 4	
Primary Trainer	5	1 0	
Basic Trainer	88	17 1	18 1
National Guard	38	7 4	7 4
Total	517	100 0	100 0

Total in terms of Percentage of Basic Force = 22.3% (517 ÷ 2,320)
Total in terms of Dollar Value = $94 000 000 or $65 700 Unit Cost.

Table 4

Expanded U. S. Air Force Aircraft Requirements by July 1, 1941

Basic Expansion	1937	1938	1939	1940	1941
Number of Planes — July 1 of each year					
Army Air Corps	992	1479	1798	(3520)	(6000)
Naval Aviation	1100	1415	1800	(2000)	(3000)

Total Purchase Requirements to meet Basic Expansion Plan and Maintain Export Market Obligations and Transport Needs

		Army	Navy	Export	Transport	Totals
Recent and Anticipated Orders — to May 15 1939		800	200	1580	100	2680
Estimated Orders from New Authorizations — by August 15 1939		2200	600			2800
Estimated Orders During Calendar Year — 1940		2200	1000	420	200	3820
Total to be Produced by July 1 1941		5200	1800	2000	300	9300
On Hand — July 1 1939		1800	1800			
Total (disregarding depletion thru Crashes and Obsolescence)		7000	3600	2000	300	9300
Estimated Depletion — Army						
1st Year	400					
2nd Year	600					
		— 1000				
Estimated Depletion — Navy						
1st Year	250					
2nd Year	350					
			—600			
Balance — July 1 1941		6000	& 3000	or 9000		

the capacity of the industry should be somewhat in excess of requirements when working under ideal conditions. "Ordering from blueprints" without service test is, at best, a chancy proposition and it is to be hoped that recourse to such method of procurement can be held to an absolute minimum.

For determining basic production capability, I have selected three factories, one building airplanes, one engines, and the other propellers, with which I am intimately familiar The airplane factory is producing planes on orders which, in quantity, approximate the average anticipated in the next two years These factories are all working now on close to a one-shift basis. In any such factory there will be a certain amount of nightwork to maintain proper balance, as it is impracticable so to equip a plant from the machine tool standpoint as to operate solely on one shift in an efficient manner. Then too, occasional nightwork, even in a one-shift factory, is essential to cover isolated operations which may have fallen down from general production plans,

Table 1 gives the basic data on actual production of a plant when on one shift and also when extended to capacity Under capacity conditions, a ten per cent floor space expansion is assumed to permit better balance. A labor concentration per square foot which cannot be exceeded efficiently by more shifts than those indicated for the capacity condition, is derived. In the case of engines and propellers, greater recourse to sub-contracting is practicable with smaller possibility of reducing the number of square feet required per man Data on unit cost per pound appears in Table 1 This basis for costs is selected as being the most readily determinable from the type of information available in the various classes of aircraft Airplane comparisons are based on weight of 'structure' which is gross weight minus the sum of useful load plus weight of engine, propeller and instruments. The "average" engine being manufactured in the particular factory studied delivers 1,050 take-off horsepower, weighs 1.2 pounds per horsepower and cost the purchaser approximately $9 00 per horsepower, or $7.50 per pound The study shows that propellers will approximate engines in cost per pound so that in subsequent investigations it is permissible to group these two units Production in terms of dollars per square foot per year are given to compare with recent estimates using such criteria. This method is not believed to be quite so satisfactory, however, as the output-per-man basis used here.

It is also important to note that in each case, a balanced condition of quantity production and of experimental work was under way in the plants studied. In the case of airplanes, sixty-five per cent of the direct labor force was engaged in producing a type currently being delivered thirty per cent on early stages of the next production order, and five per cent on experimental work. The general efficiency of the plants studied for obtaining basic production information is believed to be at least equal now to the average of the industry later during the expansion and therefore suitable to provide such basic data

Table 2 furnishes information for the aircraft industry in this country from the standpoint of floor area, labor force, and square feet of floor area per man. The floor areas given include certain factory expansion actually under way at the moment and, when extending to the capacity condition, a ten per cent further increase to secure proper balanced production The capacity possibilities of the industry are based on maintaining the same square feet per man concentration as those derived from the known capabilities of the plants described in Table 1 The significance of the other data and figures derived for them appear self-evident It should be mentioned however, that although a complete study of the instrument and accessories companies has not been made, sufficient data is available to permit a determination of the approximate labor expansion requirements in these fields

In estimating production for the next two years, in order to meet the program within that time, it is necessary to take into consideration depletions in planes, brought about by crashes and obsolescence To give an indication of the extent of these factors, Table 3 has been introduced, giving data taken from the record of testimony at Congressional Hearings and showing the number and per cent of new planes necessary each year to maintain an air force of a given total (taken to be the then authorized strength of 2,320 airplanes)

And now for the expansion program itself The tabulation of Table 4 has been prepared to establish these quantities. First there appears the basic expansion program as it has progressed in the last couple of years and as extended to July 1st, 1941, the date when the President's program must be fulfilled There then appears a tabulation, including export and transport planes (which are manufactured by many of the same firms of the industry who produce military equipment for the Government) showing the building up of quantities to give the required total, allowing for depletions which will inevitably occur during the expansion period. In estimating depletion, it should be noted that in meeting a rapidly expanding program, the rate of obsolescence will be less than will later hold when maintaining the force after the program is realized At this point, emphasis should be placed on the great necessity for allowing adequately for the production of such export and transport orders as may be available or forthcoming later, as the maintaining of these markets is extremely important to the welfare of the country as well as of the industry, particularly when looking forward to the time after our own military expansion program is accomplished. Maintaining these markets currently is the only way that retaining them afterward is possible!

In Table 5 the effect of spares is added to the airplane requirements indicated in Table 4, to give total equivalent airplanes and engines The net result is that between now and July 1st, 1941, there must be produced 10,500 airplanes and 14,670 engine propeller units Actually, because of multi-engine planes being used, there will be need for a greater number of engine units of smaller weight and power However, total horsepower to be produced will work out correctly when using the fictitious "larger" engine

In order accurately to estimate our capacity, we must know just what we are going to build—what is the "average" airplane? For this purpose, it is necessary to know the approximate composition of our air forces by types Such an estimate appears in Table 6 which, it is believed, is self-explanatory except to note that under each general classification, defined by function, there are frequently two or three types of airplane such, for instance, as under "Pursuit" where there are single-engine single-place, single-engine two-place, and twin-engine types It should be noted that in these estimates, all airplanes, no matter what function they perform, are under consideration the picture not being confused by reference to "combat only," "first line," "reserve," etc., which often makes difficult a comparative analysis of the air forces of foreign countries Table 7 furnishes a summary of important details of the "average" airplane which, during the expansion period will be produced for the Army, Navy, export and transport markets A very extensive detailed tabulation, not reproduced in this article was prepared in order to determine the results shown in Table 7 In such detailed chart, the per cent of each class (from Table 6) was multiplied by the known weights and costs of some typical airplane of that class to determine the "weighted" average figures. Unit cost figures are necessary in order later properly to "weight" production factors involving quantity and type of construction From Table 7 therefore, we can determine just what is the "average" plane we are to build when bringing our military air services up to strength and when building for export or transport markets. Figures for the private-owner field are also added for completeness

Using actual composition of the direct labor force of the industry as of January 28th, 1938, and May 1st, 1939, there is developed in Figure 8 the probable trend of labor increase during the expansion period and as well an indication of what to expect thereafter when the industry settles down merely to maintaining the size of the air forces then developed plus continuing with the markets in other fields then established or retained Naturally, these curves will not be straight lines as shown, abruptly changing at given points, but will be rounded off to form smooth curves Again it should be mentioned that considerably more sub-contracting outside of the aircraft industry may be anticipated in the construction of engine and propeller units than will maintain for the airplane itself These curves permit establishing an average labor force for the first year of the expansion the second year being considered at the capacity figure previously worked out

By the use of the data illustrated in the foregoing tables, it is possible to develop Tables 9 and 10 which show, respectively, for the airplane and the engine, the production capacity of the industry Starting with known accomplishment, figures, suitably "weighted" for size of orders and type of construction, are derived for

(Turn to page 78)

Table 5

Estimate of Spares and Total "Equivalent" Airplanes and Engines

Airplanes

	Production Requirement	Percent Spares	Equivalent Aeroplanes	Total Incl Spares "Equivalent"
Army	5200	10	520	5720
Navy	1800	20	360	2160
Export	2000	15	300	2300
Transport	500	6⅔	20	520
Totals	9500		1200	10500*

* Grand Total "Equivalent" Airplanes to be produced by July 1 1941

Engines

	Production Requirement	Present Percent Spare Engines	Anticipated Increase	"Equivalent" Engines	Total Incl Spares "Equivalent"
Army	5200	50	60	3120	8320
Navy	1800	33⅓	50	900	2750
Export	2000	25	25	500	2500
Transport	300	50	50	150	450
Totals	9300		(50%)	4670	13973
Plus 5% Engine Spares				700	700
				5370	
Plus "Equivalent" Engs	5370				
Grand Total "Equivalent" Engine Propeller Units to be Produced by July 1 1941	14670				14670

Table 6

Assumed Composition of U. S. Army and Navy Air Forces

Army Classification	Percent		Navy Classification	Percent
Pursuit — (3 types)	22	58 Combat	Fighter	11
Attack — (2 types)	12		Scout Bomber	20
Bomber — (2 types)	24		Torpedo	5
Observation — (3 types) (inc. National Guard)	16	20 Cooperation	Patrol	18
Cargo	4		Scout Observation	20
Primary Trainer	8	22 Trainer	Reserves & Marines	17
Basic, Advanced, Combat — Trainer — (3 types)	14		Cargo	1
			Primary Trainer	5
			Advanced Trainer	3
	100			100

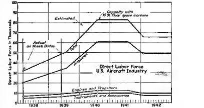
Note: Figures have been derived from published record of Congressional Hearings and Miscellaneous Estimates

Table 7

Average Size and Unit Price of Airplanes

	Avge Qnty Each Order	Gross Weight	Useful Load		Empty Weight			Structure			Engine & Propeller			*Instruments and Accessories		
	No.	Lb.	Lb.	%	Lb	%	$/Lb	Lb.	%	$/Lb.	Lb	%	$/Lb.	Lb	%	$/Lb
Army	300	11 850	3 550	30	8 300	70	$7 85	5 886	49 6	$7.90	1,984	16.7	$7 50	428	3 7	$18 00
Navy	125	10 600	4 190	39 2	6 410	60 8	8 72	4,430	42	8 35	1 594	15 1	7 50	386	3 7	19 50
Export	125	9 550	2 850	30	6 700	70	7 85	4,750	49 8	7.90	1 300	13 7	7 50	350	3 7	18.50
Transport	50	30 250	10 100	33 4	20 150	66 6	7 50	15 319	50 6	7 50	4 112	13 6	7 50	720	2 4	19 50
Average "Weighted"	250	11,750	3,750	32	7 950	68	8 00	5 550	48 2	7 27	1 878	16 1	7 50	472	3 6	18 50
Private and Small Commercial	300	1,610	630	39	980	61	3 06	655	40 8	3.41	300	18.6	8.50	25	1 0	12 00

(* Includes so-called "Government Furnished" Equipment excepting Engines and Propellers.)



AC FOR AIRCRAFT

The one hundred and one gadgets that have been added to the modern airplane have hoosted demands for electrical power to the point where auxiliary generator sets are coming in to the picture. We asked

P. C. Sandretto
Superintendent Communications Laboratory, United Air Lines

to round up the present situation regarding power supply, and point up some of the problems for the immediate future.

WHILE some of the early types of airplanes carried a storage battery, it was invariably used for ignition and, therefore, cannot be considered as intended for supplying auxiliary electric power. The battery, however, was used for this purpose when instrument board lights—the first demand for auxiliary electric power—were installed. Later came night flying with navigation and landing lights, then radio receivers and transmitters, each increasing this power demand. The practice of retracting landing gear brought with it the first application of electric motors on aircraft. Increase in passenger business introduced the demand for cabin and reading lights. Higher speed planes necessitated more powerful navigation lights, while more extensive schedules demanded more radio units.

The increase in auxiliary electric power demand is shown on Figure 1. It was realized in 1934 that the storage battery, even though it was charged by a 50-ampere generator, was no longer capable of meeting the demand placed on it and an investigation of some other source of possible electric power was begun. Figure 1 does not show the demand for auxiliary power in the form of pneumatic power for deicers and gyro instruments and hydraulic power for auto-pilots and brakes which came with the advent of the modern airplane. To meet this demand, vacuum and hydraulic pumps were necessary and increased the number of power take-offs from the main engines to the point where maintenance personnel believed that these power take-offs would effect the reliability of the main engines. Since the removal of two storage batteries would save 215 lbs., it was thought that it might be possible to justify a separate gasoline engine which would drive a generator to supply electric power and also drive all other accessories which had previously been attached to the main engine. Since this step would violate all past conventions, it was decided that a thorough study of all types of electric power should be made in order to determine which one was best suited to aircraft application. It was realized that the airplane system would not involve transformers, lights, and motors alone, but would include the generating and distributing of electric power as well. The study was therefore made on this basis. One of the purposes of this paper is to present these findings.

The first decision was whether the new source of electric power was to supply alternating or direct current. Alternating current has the following two advantages: 1.—It can readily be transformed to any voltage desired with the use of rotating machinery; 2.—Alternating current motors do not require brushes and are therefore simpler to maintain also not requiring brushes, they do not generate noise in the radio system. Direct current has the following two advantages: 1.—It can be stored and, hence, be available without operating the primary power source, 2.—Direct current motors have better torque characteristics than alternating current motors and are somewhat lighter for a given shaft speed and horse-power. Because of the number of different voltages required for radio purposes, the first advantage given for alternating current was believed to be very important; the second advantage to be of some value. It was decided that for commercial operation, the ability to store direct current was of little importance since landing at emergency fields is a very unusual occurrence. It was believed that the second advantage for direct current was not a major factor, so the decision was made in favor of A. C.

No great consideration was given to a combined A. C.-D. C. system because it was thought necessary to predetermine the amounts of each kind of power required for each application and provide generating equipment for both kinds of power. Elaborating, it might be desirable to use nearly all direct current power during one portion of a flight and nearly all alternating power during another portion, so the generating equipment for an A. C.-D. C. system would have to be twice as great as for an A. C. only or D. C. only system.

Today we can write of the various discussions concerning the problem of arriving at a standard of A. C. power for aircraft and can give a resumé of the points made by numerous engineers who have taken part in these discussions, but in the fall of 1934 when the writer first began his study of this subject, there was little information available and it was difficult to find air transport engineers who would take any but academic interest in the problem. True, some of the Services had utilized A. C. power on aircraft, but their application had been limited to radio plate supply. In 1933 United Air Lines designed a radio receiver which could be adapted to A. C. operation but the investigation of A. C. as applied to large aircraft was not begun until 1934. In January of 1935 a study of A. C. up to 200 cycles, by Heintz and Kaufman of San Francisco, was distributed among engineers of various aircraft concerns. In June of the same year, the Eclipse Aviation Corporation published an A. C. power study. This publication was restricted in its distribution. In June of 1935, Subcommittee #3 of the Radio Technical Committee for Aeronautics was appointed by the Bureau of Air Commerce for the purpose of studying A. C. power for aircraft. Without attempting to go into detail covering the points made by the various studies, the writer will attempt to sum up the substance of the various discussions.

Voltage

Following the decision that the power supplied would be A. C., work was done to determine the optimum voltage of this new supply. Complete electrical systems were designed for an airplane about the size of the Sikorsky S-42 on the assumption that the smallest wire which had enough mechanical strength to allow its being pulled through conduit without damage was #20 A.W.G. These designs gave the data plotted in Figure 2. With the wiring weight of a 12 volt installation considered as being 100%, the weight of a 120-volt system would be 10% and a 220-volt system 8%. Notice that the curve does not flatten appreciably until a voltage of 100 is used, but that the weight advantage between a 120- and a 220-volt system

(Turn to page 43)

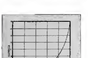


FIG. 1 K.W. OF POWER USED PER PLANE

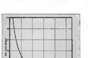


FIG. 2 COMPARISON OF PLANE WIRING WEIGHTS TO VOLTAGE

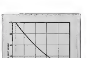


FIG. 3 RELATIVE WEIGHTS OF TRANSFORMERS AT VARIOUS FREQUENCIES

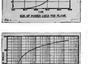


FIG. 4 MAGNETIC PROPERTIES OF IRON AT FREQUENCIES UP TO 200,000 CYCLES

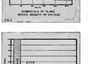


FIG. 5 FOR MOTOR OF GIVEN H.P. VOLTAGE & FRAME

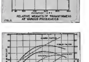


FIG. 6

Stacks and Rings

Using the exhaust gas for heating carburetor air and airplane cabins

Part III—Carburetor Air Preheat

By George F. Titterton

Executive Engineer, Grumman Aircraft Engineering Corp

THE temperature of the fuel-air mixture in a carburetor averages 60° F lower than the outside air temperature. This drop in temperature is due to the cooling effect of the fuel in vaporizing and the expansion of the mixture. It is obvious that on a damp day with the air temperature between 50° F and 90° F ideal conditions exist for the formation of ice in the carburetor. This condition can be eliminated by feeding hot air to the carburetor. Various opinions exist on how much the air temperature must be increased to be satisfactory under all conditions. The minimum satisfactory rise over outside air temperature is believed to be 60° F. This temperature rise compensates for the drop in the mixture temperature. At times when the air temperature is below 40° F the air is relatively dry and there is little moisture for the cold mixture to freeze. At any air temperature above 40° F the 60° F rise in hot air will be sufficient to keep the mixture temperature well above the freezing point.

The shroud shown in Fig 1 of the first article is capable of raising the air temperature above 90° F. This temperature increase is sufficient to provide a large margin for all weather contingencies. A similar shroud is shown in Fig 12. A collector with a 3 inch intensifier tube can raise the air temperature somewhat over 60° F. The temperature rise should be measured when the engine is developing 50-65% of its normal rated power. This power approximates the flight condition at which the airplane would be cruised under icing conditions. It is common practice to fly airplanes at all times using air preheated to 90° F to prevent any possibility of ice forming in the carburetor.

Types

There are many types of exhaust collectors and they may be classified in several ways. We have the shroud or muff type, the intensifier type, and the hot spot type. In addition we have muffs for heating cabins, and exhaust driven superchargers.

Shroud Type Exhaust Collector

The exhaust collectors shown in Figs 1 and 12 are typical examples of a shroud type collector. When the side cowling panels are buttoned in place the upper two-thirds of the exhaust collector is completely enclosed. At the upper end the cowling enclosure or shroud fairs into an entrance to the carburetor air scoop. This air scoop entrance is valve-controlled so that the hot air rising from the shroud may be either spilled into the atmosphere when not needed, or drawn into the carburetor. The spilling of the hot air provides ventilation and prevents overheating and burning of the shroud cowling. The hot air is drawn into the carburetor to prevent icing as explained under the subheading "Carburetor Air Preheat."

The muff shown in Fig 13 works on the same principle as the shroud. It is attached directly to the collector and is independent of the cowling. The muff is made of the same material as the collector. The cowling that forms the shroud may be corrosion-resisting or Inconel sheet, or the ordinary aluminum alloy cowling material if it does not touch the collector.

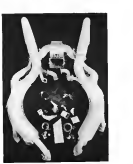
The flow of air through the shroud is caused almost entirely by the suction of the carburetor. Frequently this flow is not rapid enough to supply the required amount of air and irregular engine operation results. To overcome this difficulty it is advisable to install an air scoop extending

(*Turn to page 86*)

Based on a thesis submitted to the College of Engineering New York University New York

Courtesy Solar Aircraft Co

Fig 12 Cowling shroud and practical exhaust manifold for P & W Hornet engine. The heated air from within the shroud is led to the carburetor air scoop.



Courtesy Solar Aircraft Co

Fig 13 Exhaust manifold for Wright Cyclone R-1820-F engine. Note muff around main collector for preheating carburetor air with connection to carburetor scoop. Note also the exhaust connections for the carburetor to provide heat for the fuel-air mixture.

Courtesy Solar Aircraft Co

Fig 14. Exhaust manifold for Wright Cyclone R-1820-G3 engine. Note long single exhaust extension with cabin heater tube projecting from each end. Also intensifier tubes in main collector ring

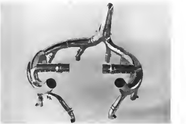
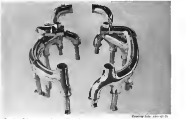


Fig 15. Exhaust manifold for P & W Hornet engine. Note muff for carburetor hot spot and muff around main collector ring for heating cabin air.

Courtesy Solar Aircraft Co

Fig 16 Outlet assembly for Wright R-1820-G 102 engine. Note dome shaped ends to match spring loaded flexible connections. These flexible connections absorb movement between outlets which are mounted rigidly to the nacelle structure and the main collector ring mounted on engine.

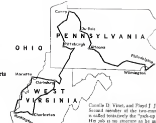


Courtesy Solar Aircraft Co

Fig 17 Exhaust manifold for P & W R-1535 engine. Note complete heater muff for pre-heating carburetor air.

Snatching the Mail

All-American Aviation Starts Airplane Pick-up Service



When our ancestors gathered down by the railroad tracks to watch the trans-continental flier pick off a sack of mail at 40 m.p.h. they were treated to a picayune performance. Now we can drive down to the local airport, be it ever so humble, and see an airplane zoom down between a pair of flagpoles and snatch off a mail pouch at 100 m.p.h. If we watch closely we can see delivery was made almost simultaneously. Regular mail service was inaugurated May 12 by All-American Aviation, Inc., on two routes—No. 1001, Philadelphia to Pittsburgh and No. 1002, Pittsburgh, Huntington, Charleston. Intermediate stops will be added on a staggered schedule and, by early July, 58 cities will be served, in fulfillment of a one-year experimental contract recently awarded by the Post Office Department.

Air Mail Route 1001

West Bound a.m.		East Bound p.m.	Starting Date
Lv 8:00	Philadelphia, Pa	Ar 5:15	May 14
8:15	Wilmington, Del	5:00	June 4
8:28	West Chester, Pa	4:52	July 8
8:39	Coatesville, Pa	4:45	May 14
9:48	Lancaster, Pa	4:30	June 18
9:51	Columbia, Pa	4:24	July 2
9:58	York, Pa	4:17	June 4
10:09	Hanover, Pa	4:06	July 2
10:17	Gettysburg, Pa	3:58	May 14
10:31	Chambersburg, Pa	3:44	June 19
10:40	Mount Union, Pa	3:28	June 4
10:53	Huntingdon, Pa	3:10	June 18
11:07	Altoona, Pa	3:08	July 9
11:18	Tyrone, Pa	3:00	June 4
11:30	Clearfield, Pa	2:45	May 14
Ar 11:40	DuBois, Pa	Ar 2:30 Lv	May 14
p.m.			
3:50	DuBois, Pa	Ar 11:59	
4:05	Ridgway, Pa	11:44	July 8
4:14	Kane, Pa	11:35	June 4
4:27	Warren, Pa	11:14	May 14
4:42	Corry, Pa	11:07	May 14
4:56	Titusville, Pa	10:50	July 8
5:05	Oil City, Pa	10:42	June 4
5:06	Franklin, Pa	10:40	June 4
5:22	Grove City, Pa	10:27	May 14
5:36	Butler, Pa	10:13	June 18
5.49	New Kensington, Pa.—Natrona, Pa	8.31	July 8
p.m.		a.m.	
Ar 6:00	Pittsburgh, Pa	8:00	May 14

Operations Manager James Ray has been busy building up his organization which now includes Pilots Holgar Hoirns, Thomas F. Kincheloe, James V. Piersol, Norman Rentoul

Air Mail Route 1002

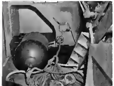
South Bound a.m.		North Bound p.m.	Starting Date
Lv 9:40	Pittsburgh, Pa	Ar 6:00	May 12
9:50	Irwin-Jeannette-Greensburg, Pa	5:50	June 11
9:54	Latrobe, Pa	5:42	May 12
10:05	Mt Pleasant, Pa	5:35	May 28
10:11	Connellsville, Pa	5:29	May 28
10:18	Uniontown, Pa	5:21	June 11
10:30	Morgantown, W. Va	5:10	May 10
10:40	Fairmont, W. Va	5:00	June 11
10:47	Grafton, W. Va	4:55	June 25
10:55	Philippi, W. Va	4:45	June 25
11:06	Clarksburg, W. Va	4:34	May 12
11:23	West Union, W. Va		June 25
11:37	St. Marys, W. Va		June 11
11:44	Marietta, Ohio		May 10
11:50	Parkersburg, W. Va		May 28
12:08	Pomeroy, Ohio		June 11
12:18	Pt. Pleasant, W. Va., Gallipolis, Ohio		May 28
Ar 12:37	Huntington, W. Va.		May 10
Lv 3:00	Huntington, W. Va		
3:12	Barboursville, W. Va		June 25
3:18	Milton-Hurricane, W. Va.		May 28
3:26	Nitro-Dunbar-Charleston, W. Va		May 10
3:51	Spencer, W. Va		May 12
4:01	Grantsville, W. Va		June 25
4:20	Glenville, W. Va		May 28
4:28	Weston, W. Va		May 12

Camille D. Vinet, and Floyd J. Judson. Second member of the two-man crew is called tentatively the "pick-up man." His job is no sinecure as he must let down the outgoing bag and haul up the incoming one at each stop, and sort pouches between times. Pioneer sky mail clerks so far selected include

(Turn to page 39)


D


E



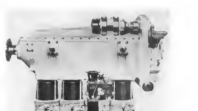
A—Mail bins behind and beside the pilots seat are used in sorting pouches

B—A bag ready to be dropped through the hole in the cabin floor. The cable release is at the center and the winch at the right

C—Detail of the winch with its long shock absorber at the right

D—Mail bag suspended and ready for pick up

E—Detail of hook attachment of ropes

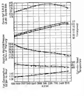


Flying Equipment

Monsoon 100 hp. Engine

American Version of French Regnier has Hobson Carburetor

REMINISCENT of the time when the American Cirrus and Wright Gipsy engines powered so many of our American training planes, we find currently another foreign invasion of the low power field, again an in-line type powerplant. To be known in this country as the Monsoon, the new engine is an Americanized version of the French Regnier, offered by the Allied Aviation Corporation, Van Nuys, Calif. The Monsoon now holds ATC No. 208 with a rating of 100 h.p. at 2285 rpm at sea-level. The original Regnier holds an I.C.A.N. approval for Europe, and is currently used in a number of French sport and training planes. In addition to full manufacturing rights on the Regnier, the Allied Aviation Corp. holds manufacturing rights for this country on the Hobson carburetor which is fitted. Other rights are being negotiated on such units as magnetos, starters, generators, and propellers, with the intention of offering a completely integrated power unit. Manufacturing operations are now being handled through sub-contracting of work to specialty manufacturers, with final assembly and test work conducted in the shops of Allied Aviation Corp. A new corporation formed for the purpose of introducing the Monsoon engine to the American market, Allied Aviation Corp. is being financed by a public stock offering designed to raise



$240,000. Officers of the company are Joseph L. Cohn, president and director; John J. Sheridan, vice president and director; Walter Hawkins, director; Robert Blair, director; and J. Elmer Haller, secretary, treasurer, and director.

With a dry weight of but 205 lbs., the Monsoon is said to be the lightest engine in the world in its power class. Design is conventional, with four cylinders arranged in-line, inverted and air-cooled. Features include fully enclosed valve gear, machine gun synchronizer mounts, and a triple oiling system that provides positive lubrication in all positions, including upside-down flight. The engine is being introduced at a low price, and it is also claimed that operation and maintenance costs are unusually low. Fuel consumption is given as .42 lb./hp. hr., and oil consumption, .004 lb./hp. hr.

Construction provides a heat treated cast aluminum alloy crankcase, with magnesium alloy cover and accessory case. Four detachable mounting arms bolt to the sides of the case. The four-throw forged steel crankshaft is mounted in five main bearings. Connecting rods are of forged duralumin and pistons of heat-treated cast aluminum alloy with two compression and one oil ring. Cylinder assemblies consist of a forged steel barrel machined all over and finned, with a heat-treated aluminum alloy head held to the cylinder and case by long studs. Magnetos and the accessory drive are mounted at the top rear of the engine.

Specifications by the manufacturer

Type	4-cyl., in-line, inverted air cooled
Name	Monsoon
ATC No.	208
Bore	4 in.
Stroke	4.48 in.
Horsepower	100 at 2285 rpm at sea level
Compression ratio	6.25 to 1
Fuel consumption	.42 lb./hp. hr. at rated power
Oil consumption	.004 " " " " "
Width	12.36 in.
Height	27 in.
Length	37.75 in.
Weight	205 lbs.
Fuel pumps	2

Accessories—Scintilla magnetos, Allied (Claudel Hobson) carburetor, Eclipse starter (optional), B. G. spark plugs.

"Hush-Hush" Boat

Twin engined Consolidated combines high speed and long range

Consolidated's "hush-hush" mystery plane, the Model 31 twin-engined flying boat, took to the air May 5th with William Wheatley at the controls. The new ship, a high-wing cantilever monoplane, of all metal construction, combines high speed, long range, and heavy striking power in a plane of relatively small size. It is powered with two Wright 18 cylinder twin-row engines rated 2,000 hp for takeoff, driving 16' dia. Hamilton-Standard 3 blade propellers. Stability on the water is provided by outboard floats which retract against the under side of the wing in flight. The relatively high taper of the wing prevents tip retraction of the floats as on the PBY series. A tricycle beaching gear is permanently attached and is also fully retractable within hull wells. Although intended strictly as a beaching gear, it is believed rugged enough to withstand airport landings in an emergency.

Gross weight is approximately 50,000 lb., wing span 110 ft., over-all length 73 ft., height 22 ft., and maximum wing chord 14 ft. Although little detailed information is available, it is understood to have a wing with high taper ratio, an aspect ratio of approximately ten to one, and a maximum loading of more than 45 lb. per sq ft. Gross wing area is reported at approximately 1100 sq ft. Of particular interest is the use of a new type airfoil recently developed by David R. Davis, independent aeronautical engineer. The Davis airfoil is reported to possess a number of interesting characteristics, including low drag and low center of pressure travel. Hydraulically operated Fowler wing flaps assist landings and take-offs. Although no performance estimates have been released, engineers have estimated the plane to have a top speed ranging from 285 m.p.h. to upward of 300 m.p.h., and an all-out maximum range, if stripped for record purposes, of better than 10,000 miles.

Reports of preliminary taxiing tests and of the test flight which lasted approximately one hour, credited the plane with excellent stability on the water, quick take-off, and smooth landing. The hull is of unique design and is said to be the result of the newest testing technique in the Langley Field towing basin, where complete scale models are now being "flown" off the water instead of limiting test runs with a bare hull. The Model 31 differs materially from current hull design, having unusual depth of hull combined with a relatively narrow planing bottom, and a peculiarly stubby appearance aft.

Closeup of the Consolidated Model 31 showing the method of retracting the wing tip floats and the permanent retractable beaching gear

In construction the Consolidated Model 31 is of conventional skin stressed design. The wings, tail surfaces, and planing surface of the hull bottom are all flush riveted. Ailerons, flaps, rudders and elevators are fabric covered. The tail consists of a cantilever stabilizer with twin fins and rudders mounted at the ends.

Two flight decks are provided in the hull, one above the other, providing a large flight control compartment, and eight additional compartments for passengers and payload. As a commercial airliner the Model 31 has a day capacity of 52 passengers and a night capacity of 28 passengers, with sleeper accommodations. It is said to be capable of operating in trans-Atlantic service with a load of 28 passengers. Cruising speed on 50 per cent power has been unofficially estimated at better than 200 m.p.h. As a military airplane the Model 31 would augment the PBY series of twin-engine patrol bombers which it greatly exceeds in speed, range, and load carrying ability. However, the plane is a private venture on the part of Consolidated Aircraft Corp., not having been subject to the ordinary procurement routine which adds so materially to the cost and time for construction of prototype military aircraft. As a result the design was developed, built and test flown within a period of only ten months, instead of the two to three years required heretofore under normal procurement procedure.

Military men who have knowledge of the capabilities of the Model 31 base their high estimate of its naval effectiveness primarily on its ability to locate and destroy with relative ease all but the most heavily armed surface vessels. With its high speed, long range, and ability to carry a heavy bomb load, the Model 31 is believed capable of sweeping large areas of ocean entirely free of all enemy vessels except heavily protected fleets of heavy warships. It is pointed out that its high speed makes this plane nearly immune against attack by pursuit planes of current vintage, and materially reduces effectiveness of anti-aircraft fire against it. Yet the bomb carrying capacity is sufficient to cripple any ship afloat if hit but once by a bomb of the maximum size this plane can carry.

No further information on the plane is available as we go to press, but aviation people everywhere may well watch with interest for word of civil or military application of the Consolidated Model 31.

A distinctive feature of the Model 31 is the permanent beaching gear of the tricycle type which is fully retractable within wells in the hull. Although it is intended primarily for beaching, the gear is believed to be rugged enough to withstand airport landings in an emergency

Snatching the Mail

(Continued from page 34)

Glyn Rymer, Delton R. Osborne, and Victor Yesulaites. Maintenance of the fleet of six Stinson Reliants, is under the direction of Charles H. Cadiz, at the Pittsburgh headquarters. John R. Basley is assistant operations manager.

Mechanical details of the pick-up device have been ironed out over many months of experimenting by Vice-President Lytle S. Adams and President Richard C. du Pont. In its present form the apparatus is extremely simple. On the ground all that is required is two steel masts, 40 ft. high with ten foot markers above them to make them more easily distinguishable from the air. Each mast is fitted with an ordinary pulley and rope with a weight and glider hook designed to open at about 125-150 lb pull. The cross rope, on which the bag is free to travel, is attached to the hooks on either end and raised into position by a ground crew of one or two men. The ship drags a cable fitted with a 4 prong grapple which engages the cross-rope on either side of the bag. The grapple slides to a knot in one end of the rope while the bag slides to the other end and the pick-up man pulls in both rope and cable by a winch mounted on a long shock absorber in the cabin of the ship. The bag for delivery is suspended on a 65 ft. cable and released by the pilot before the pick-up contact is made. With a little practice it is possible to land the delivered bag within a few feet of the poles. Bags are protected by a tough, light-weight material to protect their contents. Landing facilities are unnecessary as very little space is required for the pick-up device and no provision for landings is made in the schedule.

AVIATION Photo

Pick-up man Rymer and Pilots Kincheloe, Hoitis and Pierson (left to right) discussing the technique at the experimental field at Coatesville, Pa.

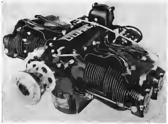
Flying Equipment

Greenwood-Yates Monoplane

Geodetics in the Northwest. From Portland, Ore., comes news of the Greenwood-Yates Monoplane, a twin-engined ship with both wing and fuselage of geodetic construction. For further details see page 64

Eagle of Iraq

New Flying Carpet for the Regent of Bagdad is this Spartan Executive designed especially for the late King and built to his Majesty's specifications through arrangements made by Aviation Equipment and Export Inc. A standard model, the Eagle of Iraq is powered with a Pratt & Whitney Wasp Junior engine and Hamilton Standard Constant Speed Propeller. Color scheme is red and gold both inside and out. The interior is finished in costly Antique Velour and is fitted with Irvin chair parachutes. Other special equipment includes Simon Radio Guide, Walker Communicator, and many special instruments.



Lycoming 65

For the largest lightplane models Lycoming has just introduced the Model 65, a direct drive, horizontally opposed type available with single or dual magneto ignition. Designated O-145-B Series, the new engine is approved by the C. A. A. for a rating of 75 hp. at 3100 r.p.m., but will be featured as the "65" until more light planes are stressed for 75 hp. engines

AC for Aircraft

Continued from page 31)

is small. Because most wire used in airplanes has insulation sufficient to allow its use for 120 but not for 220 volts and because of the greater danger to operating personnel if the voltage were 220, a voltage in the vicinity of 120 seemed optimum.

When the above data were presented to the A. C. Subcommittee, two members suggested that 32 to 48 volts would be more nearly optimum. The findings of these men were based on a study of smaller airplanes, particularly where storage batteries were used, and their statement probably holds true for this case. As previously stated, for commercial flying the airlines do not consider electrical storage necessary and were considering the new electrical system for use on only large airplanes. In view of these facts the only argument for a system having less than 100 volts was the thought that since the filaments for 115-volt lamps are smaller in diameter than those of 32-volt lamps, they would be unable to withstand airplane vibration. A series of small 115-volt bulbs were placed on life test by alternately being burned for 200 hours, then attached to an airplane for a flying time of 200 hours. It was found that bulbs ranging in size from 6 to 20 watts all gave on the average of 1000 hours of life. There was apparently no correlation between filament size and life. The 6-watt bulbs had an average life of nearly 2000 hours. Apparently lamp life was more a function of the method of supporting the filament than filament diameter.

Discussion of Frequency

The frequency of an A. C. system has a direct bearing on the pounds per kilowatt weight of a transformer. The higher the frequency the lighter will be the weight of the transformer used for supplying radio apparatus voltage, instrument light voltage, and booster coil voltage. This phenomena is shown on Figure 3. The weight of a 60-cycle transformer is considered at 100% in Figure 3, and is seen to be about 59% for 400 cycles, 27% for 000 cycles, and 18% for 1000 cycles. Lower weight transformers could probably be obtained if the frequency were further increased. Neglecting any reference to motors, for the time being, arguments were advanced for 270, 360, 800, and later 400 cycles. The arguments against 000 cycles, the proposed frequency of the group which would give the lightest transformer weights, were as follows: 1—Transformer efficiency would be poor at this frequency; 2—Because the human ear is very sensitive to an 800-cycle tone, it would be impossible to operate a radio receiver's plate and heater without undue hum in the receiver output. The first argument was answered by the curve given in Figure 4. This curve appeared in a paper[1] by E. F. M. Alexanderson and describes some transformers, the efficiency of which increased, not decreased, with increasing frequency up to 200,000 cycles. The second argument was answered by constructing radio receivers with 800-cycle plate and heater power supplies. A measurement of the hum from these supplies showed values of 60 db below 6 milliwatts, a value much less than that obtained for a dynamotor plate supply and a battery heater supply.

Directly, frequency cannot be said to affect motor weights. For a given motor type, weight per horse-power output is a function of its shaft speed. The synchronous (maximum) speed of a 400-cycle motor is 24,000 R.P.M., of an 800-cycle motor 48,000 R.P.M. If both types of motors were to be operated at their maximum speeds, the 800-cycle motor would be lighter than the 400-cycle motor, but if an 800-cycle motor were designed to operate at 24,000 R.P.M., other things being equal, both the 800- and 400-cycle motors would have approximately the same weight. The other indirect relation existing between motor weight and frequency is that for a given reactance, a condenser used for correcting the power factor of a three-phase motor or for producing the second-phase voltage in a split-phase motor must have twice the capacity and hence nearly twice the weight at 400 cycles that it has at 800 cycles.

A relationship exists between frequency and phase which will be discussed later.

Phase Discussion

The choice of phase affects the motors and distribution system. When more phases are used by a distribution system, more switches, fuses, and wires are necessary. While the total weight of copper is the same for the same distance of transmission, same amount of power to be transmitted, a given per cent loss, and the same voltage to neutral for a two wire single phase, a four-wire two-phase, or a three-wire three-phase system, yet the total weight of conductors for a multiphase system will be greater because of greater amount of insulation and larger diameter conduits required. For example, the weight of insulation on a three-phase system will be about 22.5% greater than that on a single-phase two-wire system. With a single-phase system it is convenient to use the airplane structure for a ground return, thus making for a lighter distribution system, but the necessity for keeping a three-phase system properly balanced dictates the use of three conductors.

Phase affects motor weights as shown on Figure 5. This figure shows that if the weight of a single-phase motor is considered as 100%, the weight of a similar two-phase motor will be 60%, of a three-phase motor 52%, and a D. C. motor 50%. If a motor is designed for three-phase, it can follow conventional squirrel-cage motor design, but if designed for single-phase, it had best be a "so-called" split-phase or condenser motor. A condenser motor is, in fact, a two-phase motor which obtains its other phase from a condenser in series with the first phase. These designs are the most practical since small high-speed motors with wound rotors that must withstand high peripheral velocities are difficult to build.

In order to secure high torques in a condenser motor, it is necessary to use low reactance condensers, and, as previously stated, the higher the frequency the lower is the weight of a given condenser for any desired capacity; hence, if a condenser motor is to be used, the frequency had best be more than 500 cycles. If a system is to have a frequency of 500 cycles or more, and it is desired to use a conventional three-phase alternator with good wave form, an adequate number of slots per pole per phase must be used. If this machine had previously been designed at a lower frequency to have the narrowest tooth practical, the diameter, and hence the weight of the machine, must be increased for the higher frequency. If the supply is to be single-phase and high frequency, an inductor alternator can be used to advantage. Such a machine has been built and has given splendid efficiency and a large number of watts per pound.

In view of the above discussion, I *(Turn to page 45)*

[1] Alexanderson, E. F. M.—Magnetic Properties of Trans. at Frequencies up to 200,000 Cycles, Transactions A.I.E.E. Vol. 30, p. 2447

AVIATION RADIO

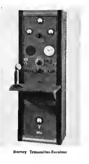
Dialing the Air Waves with Don Fink

Airport Combination

A transmitter-receiver for airport use

THE HARVEY RADIO LABORATORIES, Cambridge, working in collaboration with the Boston-Maine Airways and Pennsylvania-Central Airlines, have recently brought out a combined transmitter-receiver for airports. The transmitter has 50 watts output power and operates, crystal control, anywhere in the region from 2,500 to 7,000 kc., either unmodulated, tone modulated or voice-modulated. The radio frequency line-up is simple, since it uses simply a 42 crystal oscillator and a type RK28 power amplifier. The modulator is a 6F6 driven by two speech amplifiers. The tone generator is a 6N7. The microphone is of the crystal type with a push-to-talk switch. The receiver is similar to the type RCE made by the National Company but modified especially for this purpose. The frequency range includes the weather band, 200 to 400 kilocycles, as well as the intermediate and short-wave frequencies from 1,300 kc. to 30 mc. The sensitivity is better than 1 microvolt, and the selectivity is 20 db down at 5 kc. off resonance. The high frequency oscillator can be crystal-controlled at any two frequencies in the high frequency region. Two watts of audio output power are available.

The entire unit weighs 450 lb. and consumes 750 watts with full carrier output. The receiver and transmitter filaments consume 200 watts. The equipment, as shown in the picture, is mounted in a rack cabinet approximately 67 in. high. The equipment is arranged so that it can be operated by men possessing a third-class telephone operator's license. The tuning controls are locked behind the front panel, and the only accessible control knobs are the single frequency shift knobs and the transmit-receive switch on the microphone itself.



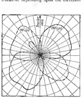
Harvey Transmitter-Receiver

125 Megacycle

Portable Radio Range Developed by Washington Institute of Technology

A NEW RADIO RANGE operating on 125 megacycles, and mounted in a trailer so that it is completely portable, has recently been developed by the engineers of the Washington Institute of Technology and delivered to the Civil Aeronautical Authority. The transmitter has an output power of 200 watts. A crystal whose frequency is 1/24 of the carrier frequency acts as the carrier source. This crystal frequency is multiplied in an 802 stage used as oscillator tripler, followed by two 807 doubler stages. This brings the frequency to 62½ megacycles at which point it is multiplied by two, in a pair of UH 51 tubes push pull. When the carrier frequency is reached a neutralized driver stage employing 100 TH feeds the output amplifier (two 250 TH tubes). No modulation is included up to the output of the transmitter, but mechanical modulation is employed in the antenna transmission line. Two frequencies of modulation are used, 90 cycles and 150 cycles, for the overlapping sectors of the range pattern.

The entire transmitter and antenna supply is mounted self contained in a trailer which can be pulled by a 1½-ton truck. The station contains the complete facilities including power generator, so it is completely independent of all outside agencies. The antenna system, several forms of which are available depending upon the direction



Horizontal pattern of 125-Mc range

of polarity and number of courses required, is mounted on a wooden frame on the top of the trailer. The modulating switches, antenna transmission lines, are driven by a self-oiled synchronous motor.

The antenna elements are silver plated and are mounted on ceramic insulators attached to the wooden support. Two types of antenna are of principal interest. One is a vertical polarized four course antenna, consisting of four vertical center-fed dipoles arranged on the corners of a horizontal square. Horizontal polarization is used to obtain either a four-course antenna or a two-course arrangement. Other combinations can be arranged according to specialized requirements, although the horizontal polarization gives the best results. The trailer which is fitted with a jack for parking purposes, can be handled readily by one man. An external power source can be used, if available, by means of connecting to the jack mounted under the trailer. It is possible to adjust the percentage modulation and the wave form of the modulating voltage by increasing or decreasing the spacing between the plates in the mechanical modulator.

The antenna system can be adjusted by varying the impedance-matching condensers. This adjustment is critical and has a marked effect upon the field pattern. Consequently, when any change is made the field pattern must be experimentally checked. A typical example of such a field strength measurement is given in the accompanying diagram. It is necessary that the transmission line, external to the trailer, be kept completely water-tight in order to avoid deleterious effects on the pattern.

A gasoline engine for generating power will operate approximately 15 hours on a single filling of fuel at full load. An important consideration is the effect of frequency regulation of the generator with respect to the modulation frequency. Since these frequencies are set by the synchronous motor which drives the mechanical modulator, it is necessary that the supply frequency be held constant within narrow limits. The generator is equipped with a speed regulator which will hold the frequency within sufficiently narrow tolerances to operate with the receiving equipment using electrical filters. If the receiving equipment has tuned-reed filters, then it is desirable to restrict the load variation on the generator to a minimum, in order to avoid frequency shifts.

The transmitter may be adjusted for a given installation, usually upon acceptance of the equipment from the manufacturer, and it may then be depended upon to hold the calibration and adjustment even when moved over rough roads to another location. The use of ultra-high frequency carriers makes the course indication independent of grounding conditions and other factors.

AC for Aircraft?

(Continued from page 43)

believe the following rule can be taken as essentially correct. *If the supply is to be three-phase, its frequency should be less than 500 cycles. If the supply is to be single-phase, its frequency should be greater than 500 cycles.*

The Crux of the Discussion

After early discussions, the arguments centered around a 400 cycle three-phase system or an 800-cycle single-phase system, particularly with regard to the application of these systems to motors and what would be the relative weight, efficiency, and torque characteristics of motors for these systems. Since these discussions, a number of successful motors of both types have ben constructed. The characteristics of two such motors are shown on Figure 6. The characteristics of these motors are not unsatisfactory; on the contrary, their efficiencies compare favorably with those given as typical for low frequency motors of the same size in the Standard Handbook for Electrical Engineers.[3]

The weights for both type of motors were found to be nearly equal, but, necessarily, the single-phase motor must have a condenser for its operation while the three-phase motor needs no such condenser. Looking at Figure 6, however,[4] it will be seen that the three-phase motor has a poorer factor than the single-phase motor, but the single-phase motor has a somewhat lower efficiency than the three-phase motor. If the three-phase motor were corrected for power factor, its lower frequency, as previously stated, will demand higher weight condensers than those used with the condenser motor. The power plant for the single-phase motor must be made somewhat larger because of its lower efficiency, so we find that in the final analysis the weights seem equal for both cases.

This conclusion was hardly reached when the following argument confronted us: "a large portion of the motors on an airplane, such as those used for landing gear, flaps, starters, etc., are short duty motors and are not operated simultaneously; hence, we can use the three-phase motor and need not correct it for power factor. Furthermore, single-phase high-torque motors (all of the short-duty motors seem to be high-torque also) require a centrifugal switch to change capacity, and this switch is an undesirable feature."

We believe the above statement adequately expresses the only real advantages of the three-phase over the single-phase system, while the statement previously made concerning transformers expresses an advantage of the single-phase over the three-phase system.

From empirical data, the following equation was developed and it is believed usable as a criterion for judging the relative advantages of the two systems for specific cases:

$$\frac{6262 \times \text{transformer watts}}{72 \times \text{Hp. of momentary duty motors} + 25} = ?$$

If, in the above expression, the resultant value is greater than one, the weight advantage lies with the single-phase system; if less than one, with the three-phase system. The above equation does not express the additional weight of a three-phase over a single-phase distribution system, nor the important consideration of the disadvantages of this system which can be expressed as follows:

$$\frac{\text{disadvantage of 3 wires, switches, fuses}}{\text{disadvantage of centrifugal switch}} = ?$$

Again in this expression, a quotient greater than one indicates an advantage for a single-phase system, less than one for a three-phase system. No rigorous numbers are available for use in this second expression, only opinion based on previous electrical maintenance experience on aircraft alone is the criterion. For the DC-4 airplane, the ratio for the first expression is greater than unity and our shop repair records would place the value of the second expression also at more than unity.

Will the future airplanes change the ratio as given above? Possibly, but as far as commercial airplanes are concerned there seems to be a tendency to handle high-torque monetary-duty applications by hydraulic means. The older Lockheed "Electra" used a motor-driven retractile landing gear, but the new Lockheed "14" uses a hydraulic system. While no copious data are available to support my contention, apparently the growing application of the hydraulic system shows that it can best handle high-torque, short-duty applications.

Conclusion

In conclusion we can say that both the three-phase 400-cycle system at 115 volts and the single-phase 800-cycle system at the same voltage are practical. The advantage of one over the other can be deduced from the equations given above. Apparently, the last argument centers around which of two systems, neither eminently suited to perform a certain duty, does it best.

[3] Standard Handbook for Electrical Engineers. Sixth Edition. Page 822. McGraw-Hill Book Company, Inc. 1933.

[4] Data through courtesy of Eclipse Aviation Corporation.

WORLD'S LARGEST DE-ICER INSTALLATION MADE FOR PAN AMERICAN'S 'YANKEE CLIPPER' BY GOODRICH!

Above: Installing a part of the Goodrich DE-ICER on the leading edge of the wing Workmen are here fixing the huge rubber "overshoe" to a section between the hull and the right inboard nacelle

★

At left Even the leading edges of the tail group are protected by the Goodrich DE-ICER. The horizontal stabilizer is 45 feet long and alone has a surface area greater than many a modern plane.

New History-Making Boeing-Built Clipper Protected on Over-Atlantic Flights by Goodrich DE-ICERS

ALL ABOARD FOR EUROPE! The 74-passenger Pan American 'Yankee Clipper'—designed and built by the Boeing Aircraft Company—proudly takes its place in the fleet of an air line renowned in both hemispheres for its leadership in transoceanic flying And an admiring world whose imagination is stirred by this latest advance of American aviation says "well done" to its builders and flyers.

Once again, too, Goodrich Aviation Products—veterans of practically all of the world's most important flights—are "on the job". In building DE-ICERS for the 'Yankee Clipper' Goodrich drew upon its knowledge of icing problems—gained from years of experience in furnishing DE-ICERS for leading air lines on every continent. Whether you need Goodrich Airplane Silvertown Tires ... Goodrich DE-ICERS ... the new Goodrich E-T* Brakes ... or any of the more than 40 other Goodrich Aviation Products ... you can depend on this broader, more valuable 'Goodrich experience' to give you the latest, most advanced developments. Write Dept 684, Aeronautical Division of The B F Goodrich Co, Akron, Ohio, for complete details.

*Expander Tube

'BRAIN CENTER' of Pan American's 74-passenger 'Yankee Clipper' is this spacious sound-proofed Flight Deck where Pan American's 50 million miles of over-water flying experience is put to active use. From here the swift course of this 41-ton air giant is plotted and flown as it speeds high over the waves of the Atlantic. And from here, too, the Goodrich DE-ICERS along its vast expanses of wing will be controlled and put into operation whenever ice conditions are met.

WORLD'S LARGEST TRANSPORT! The Boeing-Built Pan American 'Yankee Clipper' measures 152 feet between its wing tips! And along leading edges the gigantic wing is protected by Goodrich DE-ICERS

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes—including Tires—Tail Wheels—Abrasion Shoes—DE-ICERS—Matting—Rubber Hose—Grommets—Shock Absorber Cord—A Complete Line of Rubber Aeronautical Accessories.

BUYER'S LOG BOOK

What's New in Accessories, Materials, Supplies, and Equipment

Formed to market aircraft engine exhaust silencers and special exhaust manifolds, pipes, and carburetor air heaters, the Davis Aircraft Company has placed on the market an efficient and attractive exhaust silencer designed for current types of 40, 50 and 60 hp. engines Manifolds are also manufactured as replacement equipment for Menasco, Continental, Franklin and Lycoming engines in this power class.

The Davis exhaust silencer is of torpedo shape formed from Inconel, which retains a bright finish indefinitely, adding materially to the appearance of a plane on which it is mounted Acting on a combination of principles, the Davis silencer provides an enclosed expansion chamber for the exhaust gases and then mixes them with cold air from the slipstream by means of a venturi throat which forces air though the center of the torpedo exhaust silencer At the rear of the silencer the gases pass out through a steel mesh cone which further eliminates both heat and noise Even at night no flames are visible from the exhaust end of the silencer.—AVIATION, *June, 1939*

A new type of flush mounting fastener having many aircraft applications has been developed by the Camloc Fastener Company, 122 East 42nd Street New York. Among the advantages emphasized by the manufacturer are simplicity of assembly, low weight, compact dimensions, improved aerodynamic properties, strength, and ease of maintenance Weight of complete fastener is less than .03 lb—AVIATION, *June, 1939*.

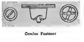
Liquidometer offers a new line of DC electric pressure gages which are the result of several years of intensive experimental and research work. There are three different transmitters, one for fuel pressure, one for oil pressure, and one for manifold pressure. The electrical resistance assemblies in all these units are similar This interchangeable feature simplifies the replacement and spare parts problem The design, similarity and accuracy of manufacture of the transmitters is such as to make it unnecessary to provide individually calibrated indicators For example, any oil pressure transmitter can be used with any oil pressure indicator, any fuel pressure transmitter with any fuel pressure indicator, and any manifold pressure transmitter with any manifold pressure indicator Indicators may be furnished with or without indirect lighting The transmitter can be mounted in any position near the engine.—AVIATION, *June, 1939*

New fabricating facilities for beryllium alloys have been announced by The Beryllium Corp of Pennsylvania. Heretofore beryllium alloys have been supplied commercially only in cast or ingot form Now beryllium copper, beryllium cobalt-copper, beryllium-chromium-copper, beryllium-nickel, and other alloys are available in the primary fabricated shapes of heat-treated rod, strip and wire—AVIATION, *June, 1939*

To saw out medium and small sized dies, punches, stripper plates, and other miscellaneous parts, an open end band saw designated Model OS 14 has been introduced by Grob Brothers, of Grafton, Wis. The many advantages of this new tool make it particularly desirable for aircraft die work The set up for internal sawing requires only 15 seconds The blade is removed from one opening into another, ready for sawing, with equal ease The machine employs saw blades of 1/16 in., 3/16 in., and 1/4 in. width All saw blades are 150 ft long and are wound helically on a drum with a threaded groove—AVIATION, *June, 1939*.

Just as a tough little tug boat is required to escort an ocean liner through a busy harbor—so this Oliver "70" tractor handles giant TWA "Sky Club" planes at Kansas City airport TWA has purchased a fleet of seven high compression "70" tractors from Oliver Farm Equipment for service at four of the largest airports—AVIATION, *June, 1939*

Davis Exhaust Silencer

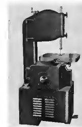


Camloc Fastener

Liquidometer Instruments and Transmitter

Oliver "70" Tractor

B-line Indicator



Grob Band Saw Model OS-14

A new bearing indicator of simple design for use in radio navigation has been developed by A D Niemeyer of the Civil Aeronautics Authority, and is being marketed by the B-Line Course & Bearing Indicator Co, of Chicago, Ill The B-Line Indicator gives quick reference for any desired turn, works out such problems as wind draft, giving direction and degree of drift, bearing from radio station to field, and other procedure problems. An ingenious feature of the instrument is a miniature airplane that rotates with the chart to show the correct position of the plane and heading at any stage of navigation procedure A large number of radio range charts are furnished with each instrument as standard equipment, and are maintained up to date at all times.—AVIATION, *June, 1939*

A standardized aircraft steam heating system based on extensive experience with custom building of various types of special heating arrangements for aircraft, in conjunction with its specialized manufacture of exhaust collector rings is announced by the Solar Aircraft Co, San Diego, Calif It is to be marketed under the trade name "AIRMAX"

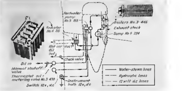
The new boiler of extremely simple design, which has demonstrated its ability to withstand severe service conditions. Such boiler units already having thousands of hours of service, are still in excellent condition This boiler is of "flash" type and is installed in the exhaust manifold or exhaust tailpipe With a generating capacity of 40,000 B T U per hour, the boiler has a weight of but 6½ lbs, a length of 7½ in, and diameter of 3 in. As many as four boiler units may be connected in series for large heating requirements Working in conjunction with the Airmax boiler is a special radiator of 40,000 B T U size The entire Airmax system has been made fully automatic and reduced to a single electric switch for turning the system on or off Yet the weight of a complete Airmax system, of 40,000 B T U capacity, including water is only **21 lbs.**

However, in order to reduce maintenance, the Airmax heating system is completely sealed and provided with a special sump into which the water drains when the engine is shut off The feed-water pump to supply the boiler is driven from any hydraulic oil supply such as that of the gyro pilot or retracting landing gear systems, running from 125 to 1 000 lbs per sq in—AVIATION, *June, 1939*

SPARK PLUG SERVICE AND MAINTENANCE MANUAL (*in Spanish*)—A 32-page booklet devoted to servicing methods and listing equipment for service and maintenance. B G Corporation, 136 W 52nd St, New York

LOK-SKRU DILL FASTENERS FOR BLIND ATTACHMENTS—A 13-page loose-leaf book covering specifications and applications for Lok-Skru fasteners in aircraft work. Dill Manufacturing Co, Cleveland, O

CATALOG No. 11—Covers hand drivers and power drivers for Phillips Screws and power driver bits for slotted head screws Of particular value to any plant that is driving either slotted or Phillips head screws with power tools The Apex Machine and Tool Co, Dayton, Ohio



Radiator, Boiler and hook-up of Airmax heater

THE AVIATION NEWS
REVIEW COMMENT FORECAST
JUNE 1939

DANIEL SAYRE
C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield *Washington*
E. R. Lockin *New York*

P.A.A. Takes Lead on Atlantic

(Story on page 52)

International

Wide World

MOSKVA FROM MOSCOW MISCUES AT MISCOU: General Kokkinaki sits and surveys wreckage of the big red plane which he and Major Gordienko flew so brilliantly from Russia to the Gulf of St. Lawrence only to be forced to make an emergency landing on marshy Miscou Island. (Story on Page 55)

THE FLEETS IN! The Navy's aircraft carrier Ranger steams into New York Harbor with the rest of the Atlantic Fleet to help give a send-off to the World's Fair.

ANOTHER GERMAN has made another world's record for airplane speed over a three-kilometer course, according to reports from Berlin. This time the hero is 24-year-old pilot Wendel. The plane is the Messerschmitt Me 109 R and the speed 755.11 km. per hr., about 469 mph.

International

NATIONAL AVIATION

Industry Inspects NACA

Visit to Langley Field rouses high enthusiasm. Two new tunnels are dedicated

FOR THE FIRST TIME in two years the National Advisory Committee for Aeronautics played host on May 2 to the American Aeronautical Industry represented by four hundred engineers, scientists, plant and airline officials and a small sprinkling of the press. Perhaps each succeeding visit of inspection (this was the thirteenth) will always seem the "best ever." The yearly progress of America's Number One research center is steady enough, certainly, to make the visit evermore spectacular. In any case despite a cold drizzling rain which fell throughout the day, the four hundred guests sailed back to Washington that evening with a sense that they had been shown more new equipment and told more new things about aeronautical research than anyone had ever before seen or heard in so brief a period.

Much that was disclosed in the beautifully prepared and excellently delivered demonstrations by staff members in the different laboratories was "off the record." Among discussable items are:

A demonstration in the towing basin of a hull model formed of glass and so equipped with lights and an automatic camera that records have been secured of the exact changes of flow taking place around the model over a complete range of speeds.

A demonstration of an extreme type of venetian blind wing slots which quadruple the lift co-efficient of an ordinary wing.

A demonstration of a wing section developed in the low turbulence tunnel which preserves laminar flow over some two-thirds of the airfoil's section thus radically decreasing the wing's skin friction.

A demonstration of the occurrence of "shock waves" on various parts of airplane traveling at high speeds, although that speed is well below the speed of sound.

After a morning jammed-full with a carefully organized tour of the various laboratories, the visitors convened with many members of the NACA staff in the auditorium and heard speeches by Dr. Edward Warner, Dr. George Lewis, Dr. Vannever Bush and Col. John Jouett, dedicating two brand new units. Both are shown in accompanying photographs.

Meanwhile news had come from Washington that attempts to include funds for a new NACA base at Sunnyvale, California in the Second Deficiency Appropriation had been unsuccessful. As reported in AVIATION'S May issue, an item of four million dollars had been placed in the bill during debate on the floor of the Senate. However, House members in the ensuing conference had insisted upon its elimination. Nevertheless the cause is not lost. Plans are going forward to secure the funds in the Third Deficiency Appropriation Bill, which will come up for Congressional action some time this summer.

Colonel Lindbergh stepped into the picture when he appeared before the House Military Appropriations Subcommittee on May 17 to urge more funds for research if the U. S. hoped to keep pace with German developments. He stated that there was no need for this country to make any attempt to match Germany or any other country in numbers of airplanes, but urged the necessity of matching any one in the world in quality of our flying equipment. He placed the potential output of German aircraft industry at 20,000 units a year and indicated German superiority in all types of fighting machines except in the heavy bomber class. He strongly urged more research centers here.

P.A.A. Flies Europe Mail

Steps ahead in Atlantic race; Passenger-start due June 24

THERE'S NO DOUBT about it any more. From this time on, May 20 to May 27 will be permanently celebrated in the industry as "Trans-Atlantic" Flight Week. On May 27, 1919, the NC-4 reached Lisbon after the first Atlantic airplane crossing. On May 20, 1927, Lindbergh took-off for Paris. Now, on May 20, 1939, the Yankee Clipper, Capt. Arthur E. LaPorte commanding, lifted off the water at Port Washington, Long Island, and headed east on the first regularly scheduled airplane mail flight between the two continents.

For all the years of preparations that have gone into the project and the long weeks spent waiting for word from Washington, the opening of mail service came so swiftly it almost seemed an anti-climax. May 19, some time in the afternoon, the C.A.A. announced it had granted a route certificate to Pan American for a twice-weekly service to France and England. May 20, at 1:00 P.M. the Yankee Clipper left for Europe. It seemed just as easy as that.

Capt. LaPorte was due back in the U.S. on May 27. That same day Capt. Harold Gray was to start eastward in the Atlantic Clipper. The next week, still a third Boeing was due from the factory to take its turn and help step-up frequency of schedules. By C.A.A. ruling passenger service may start after five round trips—probably on June 24.

THIS IS NOT THE WORLD'S FAIR—but the two new tunnels dedicated May 2 by the NACA at Langley Field, Va. Both are unique. The big closed return tunnel has a 19-ft. float, is powered to reach speeds of at least 250 mph. and has a pressure range from partial vacuum up to at least two atmospheres. Observers working in the tunnel when pressures above standard are being used will pass in and out of the working section through special air-locks and a decompression chamber. The perisphere affair houses a free flight tunnel which can be tilted on gimbals so that a model can be held flying at a fixed point for the study of control effectiveness. It too can be pumped up to above standard pressure. Brilliant as these two new tunnels are, representatives of the industry on hand for their dedication saw plenty of evidence that the whole Langley Field research center was working to the capacity of every piece of equipment and everyone of its 450 research workers.

Air Corps Picks Schools

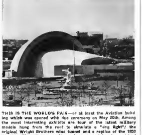
Pilot's and mechanic's classes to start July 1.

IMPORTANT PART in the Army's program to increase its air arm is its plan to use civilian schools for the preliminary stages of training for pilots and mechanics for the first time since the World War. By recruiting student pilots through three months of primary training at civilian schools the Air Corps will be able to cut its instruction course at the Randolph Field Training Center to nine months and thereby markedly increase the capacity of its training facilities. By detailing enlisted personnel to civilian mechanic schools the Air Corps will be able to relieve a great deal of pressure from its present training centers at Chanute Field, Ill. and Mowry Field at Denver, Colo.

Last month the Secretary of War announced the following schools had been selected for pilot training: Spartan School of Aeronautics, Tulsa, Okla.; Santa Maria School of Flying, Santa Maria, Calif.; Dallas Aviation School and Air College of Dallas, Texas; Ryan School of Aeronautics of San Diego, Calif.; Alabama Institute of Aeronautics, Inc. of Tuscaloosa, Ala.; Grand Central Flying School of Glendale, Calif.; Parks Air College of East St. Louis, Ill.; Lincoln Airplane and Flying School of Lincoln, Nebr.; and North Suburban Flying Corp. of Glenview, Ill.

A few days later selection was announced of the following mechanics schools: Curtiss-Wright Technical Institute of Aeronautics of Glendale, Calif.; The Aero University of Chicago, Ill.; Roosevelt Field, Inc. of Mineola, Long Island; Spartan School of Aeronautics of Tulsa, Okla.; Casey Jones School of Aeronautics of Newark, N.J.; New England Air-craft School of Boston, Mass. and Parks Air College.

The first class will enter the civilian flying schools on July 1st, and will be followed by a new class every six weeks thereafter. First students will arrive at the mechanic schools at approximately the same date.



THIS IS THE WORLD'S FAIR—or at least the Aviation building which was opened with due ceremony on May 20th. Among the most interesting exhibits are four of the latest military models hung from the roof to simulate a "dog fight"; the original Wright Brothers wind tunnel and a replica of the 1902 Wright glider; three new Navy planes; an elaborate model of some of the NACA laboratories, and an impressive lay-out dealing with transport aviation.

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

Mass Training Plans Raise Labor Problem

Half Million Mechanics Wanted!—but not now. There's the rub. Office of Education and C.A.A. in drive to train hordes of mechanics for current and possible war expansion, believe employment is available now. The unions deny this; say thousands of machinists are unemployed, thousands trying to get into aviation and can't. Mechanics can't be trained except on jobs. Reality is that if war comes there will be delay as before, over-expansion, tragic deflation afterward.

Senator Pat McCarran is regaining all those laurels as the champion of aviation that fell from his brow when he opposed the Transport Association during 1938 legislative fights. He picked up some large leaves when he got the aviation weather money put back in the Agriculture supply bill.

"Most remarkable agency in Washington" is what Senator Byrnes called the Authority. He and other Senators, not the White House, blocked Sen. McCarran's move to exempt C.A.A. from the reorganization law. But they have no immediate plans to dismember it. They will next year, though, if the three headed thing develops too many headaches.

Pilots and airlines agree—but not in writing. No contracts have been signed, but negotiations have produced amicable understanding. Pilots want system adjustment boards with decisive power, operators would give boards power only to recommend. Ultimate aim under the Railroad Labor Law is national central adjustment boards as well as local ones.

Now it can be told that State, War and Navy Departments urged reorganization of the Aeronautical Chamber of Commerce mainly to get unified effective sales promotion of planes in South America against Italian-German competition. In the next few months look for a U.S. sales and service plan to offset European barter.

Spare Parts: Roosevelt could designate the same C.A.A. chairman year after year if he wanted to . . . Lindbergh was grabbed from Military Affairs committees probably by the President himself, who remembered how his own confidential remarks were handled . . . Betting money here says N.A.C.A. will get four or five air laboratories before it gets through . . . General Kokkinaki wore long underwear in Washington's spring weather. He said that his and Major Gordienko's tasters went bad at altitude so that their coffee and cocoa was intolerably sweet . . . There will be no important patent legislation this year . . . Gravelly Point is the first airport *designed* from underground up. Dredges line out the gravel on runway foundations; silt runs to grass areas between . . . Secretary Ickes of Interior gets the Stubblefield award for discovering a new use for airplanes other than fighting, he is taking the census of antelopes in Wyoming. There are 5,000 in Grazing Districts 1 and 2, if you care . . . If airways should be shifted back to Commerce Noble would be head man, Col. J. Monroe Johnson would be No. 2 man . . . At the Press Club before hundreds, Ed Warner, new quint of the Authority, clipped off a crisp 15-minute talk on aerodynamics; Hinckley stressed pilot training as most important project in the air works . . . Military expansion of airplane production should cut the cost of commercial airplanes, but operators are not spending their discounts yet . . . Army flies about 40 per cent of total U.S. mileage, air transport about 30 per cent—which fact the latter is using to prove it shouldn't pay for airports.

DEFENSE

Congress Votes for Arms

Aviation's share of two billions is $685,000,000

CONGRESS will soon round the grandstand pylon in the armament race. When it does, over $2 000,000,000 will have been poured in the tanks and all U S peace-time defense spending records will have been broken About $1,700,000,000 is being budgeted for strictly military enterprises; the balance is for quasi-military projects such as naval auxiliary ships, rivers and harbors, civil works administered by Army and Navy, aircraft development, and the like. On the first of May, appropriations added up to $1,421,108,878 —and going strong. A rough estimate of aviation's divvy at session's close reads about $685,-000,000, (author's figures), plus commitments for more millions in the future.

Air Corps expansion

The story begins with that Army air expansion law, approved April 3, authorizing a maximum of 6,000 airplanes. Don't get tired of this new substitute for the old "Baker Board" quota, yet—you'll hear it for years The President got quick results under the Act in the shape of a $50,000,000 installment on the $300,000,000 authorized, to place immediate orders On April 27 Assistant Sec of War Louis Johnson announced award of contracts for 571 airplanes, costing $19,535,-320

Consolidated Aircraft, $2,-880,000 for Type B-24, heavy four - engine bombardment planes We can't tell how many because the War Department says don't. Curtiss-Wright, $12,-872 398 for single-engined pursuits, type P 40 Lockheed, $2,160,728 for pursuit interceptors, twin-engine, type YP 38 Bell Aircraft, $1,073,445 for pursuit interceptors, single engine type XP-39 Beech Aircraft, $528,748 for photographic ships, type F-2.

Of course you can't really buy 571 such airplanes with 19 million dollars; these jobs are without engines and accessories. The balance of the $50,000,000 is being used by the Government to purchase power plants, propellers, instruments, accessories in quantity lots, which will be turned over to the manufacturers for installation, effecting a considerable saving. First engine order went to Allison, for 800 V-12 liquid cooled units At this writing Mr. Johnson's office had not announced further award of $19,000,000, ear marked for an additional lot of attack bombers to be selected from the four Wright Field competitor's when entries are evaluated

Now, about that $250,000,000 balance of the authorized $300,-000,000 The President has asked Congress for $187,440,000 of it in cash and $24,560,000 in contract authority for the Army Remember that the Army expansion authorization was not all airplanes Out of the total sum, the Panama Canal gets $27,000,000 for structural improvements Also, expansion of the Air Corps takes $5,000,000 for additional pay roll; for more housing, $31,600,000; for airplane ordnance, $10,475,483 So that only $131,700,655 will be spent for procurement of airplanes, engines and accessories—plus the $50,000,000 already contracted. Bear in mind as we've said before that when the Air Corps gets 6,000 planes in the next two or three years it can declare that they are not all "serviceable," as the law puts it, and order some more—if Congress will put up the money

Regular A&N bills

President Roosevelt on April 26 signed the $510,000,000, 1940 military establishment appropriation, for everything from soup to nuts and bolts It provides $15,826,895 for payment on airplane procurement contracts in this year. Not less than $57,454,962 cash and contract authority is to be applied on the procurement of new airplanes, of which nearly the entire amount, $66,113,200 shall go for combat machines. Counting airplanes for which orders have been placed, airplanes not yet ordered but for which provision is made, plus the recent order for 571, the total by June 30, 1940, figures something under 1,700.

The Naval establishment appropriation for 1940 gives aviation $88,238,000 for items as follows: new aircraft, $48,888,-000; instruments, $1,500,000; maintenance, $24,300,000; experiments, $9,500,000; rigid airship, $500,000 (to start the job) The amount for new aircraft is expected to procure about 500 complete units.

"With the delivery of these planes," says the Appropriations Committee's report, "provided attrition estimates are reasonably accurate, the Navy will be in possession of about 2,132 planes, or 83 more than the objective prevailing prior to the 3,000 program authorized by the (Big Navy) Act of May 17, 1938. It is not the plan to reach the new objective prior to the close of the fiscal year 1944" (By that time Army and Navy will have a combined force of 8,000 serviceable planes —over 10,000 including obsolescent equipment.)

Some Navy problems

Though the naval 16-air-base expansion Act involves no immediate call for men and machines, it will do so in the future. It is the most spectacular spread of the eagle's wings in the last two decades. The committee chose to put the appropriation of $25,000,000, for dredging, dock and breakwater construction, in the public works program rather than in the regular Navy fund. The Budget estimate calls for $31,-821,000 this year. Committee cut it to $27,822,000 The $3,353,000 reduction applies to Midway, Wake, Johnston, and Palmyra Islands in Pacific. Nothing has yet been done about Guam, which was dropped from the program Establishment of an American "Gibralter" in Puerto Rico to guard the Panama lifeline, just ordered by the President, adds another department equal to Hawaii, the Philippines, or one of the nine corps areas

Pilot training

Naval Reserve gets $6,834,-000 This is an increase of $1,203,680 over the current appropriation. Nearly all the increase, over $1,000,000, is on account of the aviation branch and is associated in one way and another with the cadets

Opinion is that there will be no direct appropriation for the Civil Aeronautics Authority's airport program this session; that construction and improvement will go ahead under PWA and WPA work-making programs as it has in the past. But it's safe to put approximately the $125,000,000 minimum subsidy recommendation in our aviation money column

Air Corps training through civil air schools got under way when heads of the nine schools selected met in Washington with Brig. Gen. B K Yount. On the following day, Gen Yount met with the mechanics school men and mapped out the program.

Flight training in colleges was authorized long ago by the House, at a cost of $5,675,000. But Senator McCarran still stands by the $7,300,000 figures Hearings have been held on his bill, and it will be reported soon

ATTACK: First of the Vultee YA-19 attack planes to be delivered to the Air Corps

BASIC COMBAT: North American's entry in last months Wright Field competition with Curtiss-Wright and Vultee.

AVIATION ABROAD

Moscow to Miscou

That Russian attempt was something really brilliant

THAT DREAM of Russia's of trans-Arctic Airlines connecting Moscow with the Western hemisphere is certainly not dead Anyone who got within questioning distance of General Kokkinaki and Major Gordienko and their interpreters during their recent visit to Washington and New York, can assure you of that. The latest attempt, made by these two fliers, to bring such air routes closer to realization was alone ample proof of the Russian determination in this direction

The log of this flight is well worth the studying. The "Moskva" left Moscow at 9:18 P.M. (E S T) Thursday, April 27th At 12 47 A.M. it had passed the west coast of Finland and was averaging 150 miles per hour. At 5:52 A.M. it was approaching the coast of Iceland At 8:10 A.M. it was approaching Greenland and making good 172 miles per hour. At 1 28 P.M. Friday the General and the Major had sighted the coast of Labrador Little more than an hour later they were over the Gulf of St. Lawrence. Now bearing in mind that this flight was in a Westerly direction the plane's ground speed was very remarkable indeed Those who went to meet the plane at Miscou, N B report the plane (see picture, page 51) was very business-like in design and construction. A twin engine bomber of metal monocoque construction it was powered with two radial engines probably of about 800 hp. each. Since it logged four thousand miles from east to west in about eighteen hours it must have a very satisfactory top speed Its load at take-off was 25,000 lb

The cause of the flight's subsequent failure emerges fairly clearly from fragmentary reports secured from Gen Kokkinaki after his arrival in the U. S. As they approached Labrador the weather evidently grew very thick. In fact the only sight they caught of Labrador consisted of a few peaks sticking up through the murk. About 1 30 P M they apparently struck a front in the weather and began encountering strong head winds For several hours they flew through clouds which reached right up to 32,000 feet. Evidently the general and his companion tried to climb over the mess At 29,000 feet their oxygen became exhausted (the whole flight had been made above 17,000 ft.) and ice formed on their radio compass antenna. In addition to this, although no mention was made of it in the post mortems, the big Venturi tubes mounted outside the plane's cabin apparently to furnish suction for the ship's gyroscopic instruments must likewise have become plugged with ice Added to this the fliers seemed to have been unable to secure any reliable weather reports for the 800 miles of their route which lay ahead of them. Quite understandably, during the next few hours, the navigation seems to have become thoroughly disorganized. In any case as they landed at 7:00 P M in the northern-most corner of the province of New Brunswick they were no nearer New York and the World of Tomorrow than they had been in mid-afternoon. It was a disappointing ending to a bold and brilliant undertaking and the American aeronautical industry would be delighted to see the attempt repeated in the near future, preferably by the same two pioneers.

MAJOR GORDIENKO AND GENERAL KOKKINAKI
They should not feel so badly

Gets Ministry of Supply

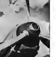
But Britain will not change present air set-up

THE BRITISH finally got the Ministry of Supply that the Opposition has been hollering for to coordinate purchases and regiment industry as necessary to increase arms production Along with this it was announced that as far as aircraft went, there would be no change in the procurement setup, as production was already going along about as fast as it could and to switch authority from the Air Ministry to the Ministry of Supply might gum the works The biggest English aviation excitement just now is over the question of air raid shelters. Sir John Anderson, Minister of Civilian Defense, has turned thumbs down on proposals to build deep community shelters. Dodging gas pipes, sewers, water mains, etc in a place like London would make their construction too difficult and expensive. The only solutions suggested were removal of as many people as possible to the country and provision of steel shelters for backyard use These were launched with some ceremony by having an eminent Cambridge scientist set off a bomb near one containing a goat, a test that was held up for some time by the Humane Society. The goat came through undamaged, however, and the eminent Cambridge scientist pronounced the shelters satisfactory

GermansBoostSpeedMark

Messerschmitt clocked at 469 mph. in short dashes

ANOTHER German speed record came along before the experts had decided just what sort of a Heinkel it was that set the 464 mph. mark early in April This time the speed was 469 mph., the pilot Fritz Wendel, (see pix on page 61) and the ship a Messerschmitt with a Mercedes-Benz engine. The same story as before was given out that it was a standard service type all around, but this doesn't check up with the few photos given out. The good sized radiator under the engine of the Me 109 has disappeared somewhere, the wings look considerably clipped, and a lot of extra fin has been added below the fuselage Beside, our guess is that the engine was turning out a lot nearer 2,000 hp. than the 1,200 at which the DB-601 is rated There's some doubt that the record will stand, since from the sketchy accounts of the run it sounds as if only one flight each way was made over the course instead of the two each way called for in the rules



THE ME 109R
Its DB-601 turned out 2,000 hp.

Down Under Looks Up

British mission to stir up Australian aviation

THE BRITISH AIR MISSION to Australia and New Zealand is apparently going to stir things up down there more than most missions do. As far as aircraft production goes, the aim apparently is not only to make Australia independent of outside sources for military planes, but also to have her produce her own commercial planes and furnish equipment for the R A F. in the Orient An immediate expansion of plant capacity to handle 800 ships a year will be started, most of it by building up a subcontracting system to feed parts to the Commonwealth Aircraft Corp at Melbourne. This outfit, started locally to build North American ships under license, has just turned out its first one after

considerable delay. Another constructor will be the Hawker-Siddeley group, which has formed an Australian company and is now looking for a place to settle down. De Havilland also has begun organization of the New Zealand plant announced last winter, which certainly makes enough companies to start an industry. To help out the immediate ship famine, England has promised to start delivering before long some of the bombers which New Zealand ordered last year, and to send out a whole load of obsolete R.A.F. equipment.

The Australian airline situation is expected to come in for one of its periodic overhaulings before long also, one which everyone hopes will be good enough to last a while. The lines have been in something of a mess most of their lives, a good bit of the blame for which falls on the government, which never got around to any sort of long-term policy. Government aid has been on a rather haphazard basis of subsidizing certain lines (about half of last year's miles flown were subsidized) which in return carry mail free, and of paying unsubsidized lines for mail on a poundage basis. The results haven't always been what the government expected, and the short life of subsidy contracts hasn't made it any easier for the lines to make plans for the future. Competition over routes with good traffic possibilities has been severe, and the company mortality rate high, but companies which die on one part of the map often pop up again somewhere else with a new name and a new route—usually one somebody else is already starving on. In spite of these troubles the Australians keep right on running airlines. They've put on a lot of new equipment, mostly American. One of the big difficulties, lack of navigation aids along the airways, is now being tackled seriously by the government, and the general feeling is that if any settled policy on subsidies and routes develops, the lines will be all set for big things. Those planning on building commercial equipment in Australia are evidently figuring on this, and also on all the nice new American equipment becoming obsolescent pretty much all at once a few years from now, just about long enough away for them to produce a home-grown airliner. The country has always been noted for high tariffs to protect local industries, which makes their chances of doing business pretty good.

Airlines Gird for War

Henri Bouché raises "spy" question as transport suffers from war jitters

THE AIRLINES of Europe are raised up to their ears right now in the current game of choosing up sides for the next war, some because they want to, some because they can't help it. The French took the worst tossing around—the route to their allies in eastern Europe, one of the first international lines to be established after the last war, disappeared along with most of the allies. One of the first things the Germans did after moving in on the Czechs was to suspend all civil flying over the region completely, cutting Prague off the line and making it necessary to hunt for another route. Then Yugoslavia refused to permission to land at Belgrade, which was further scored for the French when Ala Littoria was given the right to stop there on the way to Rumania, the terminus of the former French line. Air France did pick up a route in the Orient when regular service between Chungking and Hanoi started, but as soon as it began the Japs started laying for the Eurasia planes running in pool with the French, and they may turn out not to be particular whose ships they bag.

The British have moved into Central Europe in a bigger way than ever before so far as airlines are concerned, with British Airways doing the work. A daily service to Berlin and Warsaw, only one day away from London by Lockheed 14, brought her in close touch with her new ally. A daily flight to Budapest was also started, a run that Imperial had operated off and on in the past. More expansion was forecast by the agreement for reciprocal airlines in the new British-Rumanian treaty.

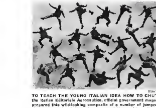
Deutsche Lufthansa, beside sending a survey flight to Japan and opening a new service to Romania (it's funny how popular Rumania has become all of a sudden) got everybody upset by some diplomatic maneuvers in Iceland. It was probably very harmless—the idea supposedly was a concession for an Iceland-Europe service—but what with the secrecy of the whole business, the fact that a German warship was there about the same time, and the general state of nerves, as much excitement broke out as if Germany had announced her intention of anschlussing the Icelanders. At any rate, Iceland didn't grant whatever it was the Germans were after, and the Dutch, whom nobody could suspect of evil designs, immediately rushed to Iceland after the same thing. If German reports are correct, she did get away with one prize out of the month's scramble, the concession for a service to Turkey, which to date has refused to grant flying rights to anyone.

Bouché cries "Spy!"

ONE of the hottest blasts issued in a long time is the one by Henri Bouché in *L'Illustration* in which he flatly accuses the Italian line Ala Littoria of being at least as much interested in spying as in running an airline. He starts out with the lines, mostly unjustified commercially, that Italy ran over Albania, and how handy that experience was when troops were flown in to take the country over. Then from a look at the map he sees a suspicious concentration of lines around Tunis, Gibraltar, and the Aegean Sea, all flying a lot more schedules than he thinks are reasonable for the traffic handled. Thus the Italians not only keep a close watch over what goes on in important parts of the Mediterranean, but pick up flying experience over regions that would be sure battlegrounds in case of war. The article isn't as important for what it accuses the Italians of doing as it is for showing how the present state of jitters is beginning to affect international airlines in Europe. There's been a big increase in prohibited zones, and in stricter enforcement of them. There are more and more cases of airliners being forced down and searched by military planes, all for being out of bounds that aren't marked as plainly in the air as on a map. Private international flying has already been loaded with red tape, restrictions, and prohibited areas until it's almost extinct, and now the airlines are being put in the Mata Hari class too.

British Press Combine

AT LONG LAST: The Royal Air Force is able to show off a complete Spitfire squadron. This one stands ready for flight at the Duxford aerodrome. Controllable all-metal propellers will eventually replace those wooden things



Wide World

TO TEACH THE YOUNG ITALIAN IDEA HOW TO CHUTE—the Italian Editoriale Aeronautica, official government magazine, prepared this wild-looking composite of a number of jumpers to show prospective bailer-outers some of the positions they can get into. The Italians recently announced the score for its airmen in the Spanish Civil (?) War. Losses: 86 planes. Opponents shot down: 943. Surface steamers sunk: 187. The Italian airplane industry is now employing 60 000 persons.

AS OTHERS FLY IT

Britain dallies while France and U. S. fly

Don't look for the British to do much on the North Atlantic before late summer. After a series of trials by the Air Ministry, the Cabot has retired to Short Bros. for some minor changes. While these probably aren't very serious, there'll be more tests when the ship gets out again. After that, if the Air Ministry carries out its original plan, will come a lot of flights around home trying out the refueling scheme before any Atlantic work is done. After all, now that the chance of starting service at the same time as Pan American has passed, it would be a lot smarter for the British to hold back until all the bugs are out than to rush in a close second. In the meantime, the French completed the first of their 1939 survey flights, May 19.

Armament story of the month is the one, supposed to be straight stuff, that Germany asked France if she wanted to put in a bid for any of the 1,600 planes taken over along with the Czechs. Since most of them had been built with French money, who says the Germans don't have a sense of humor? The story doesn't give the French answer, but it must have sounded like no, since a good share of the material is supposed to have been sent by now to Italy.

A smart idea for encouraging public interest in the R.A.F. has been cooked up under which cities with airports will each be assigned a regular R.A.F. squadron as their own baby. The boys won't necessarily be based there, but will come over for visits every now and again to show their stuff and get acquainted with the townies, all of which is expected to make the taxpayer much happier.

May Day as usual brought out the Russian air force as part of the celebration. According to the Russians, 2,300 planes participated throughout the Union. This probably refers to everything that flew and not to first line military equipment. In Moscow, where 600 military ships took part in the ceremonies, one each of several new types was shown off. Two were single place pursuits and the other two twin engined light bombers.

The French contributed a slightly bughouse note to the armament situation by announcing that, while they were still having to import fighters from outside, they would export other fighters to Sweden in exchange for anti-aircraft guns. An extra four billion francs over the regular budget has just been cut to the air force as its share of the special sales tax just decreed to raise arms money.

The least notable item in the armament survey this month, except insofar as it shows that the Germans can't have much on the English for thoroughness, is the formation under the auspices of the R.A.F. of a sort of C.A.G. for pigeons, known as the National Pigeon Reserve. Pigeon fanciers who join up will receive a badge plus £5 a year and telephone money when their birds are on active duty. This might possibly be nosed out for last place by the news that the French Air Ministry, having by decree taken over all organized aviation activity, has been forced to establish a new bureau to direct the building of model airplanes, a branch of aviation they hadn't remembered when they issued the decrees.

Keep your eye on the British West Indies as a logical place for a small but complete airline network before long. A royal commission has just come back from a long investigation of what's wrong over there, and one of the main points in their report will be the lack of cooperation between the islands, for which a lot of the blame will be put on poor and expensive communication facilities. A big hand will be given to the airline development plans just getting under way. This corner of the empire has always been the orphan child as far as aviation is concerned, since its relative poverty has kept down local development and its location off the main empire routes has kept Imperial away.

AVIATION PEOPLE

PAINTER: Lucien Cavé, perhaps the world's foremost artist specializing in aerial subjects, is now in the U. S. He is official artist for the Air Ministry and Aero Club of France.

TWO OF A KIND: John Wagner, chief test pilot for Vultee (left) poses with Edmund T. Allen, internationally known test-pilot and consulting engineer, who has joined the Boeing Aircraft Company as Chief of its Research Division. First job, the resumption of tests on the Boeing Stratoliner scheduled to begin on the second of these ships late last month

PAN AMERICAN: John M. Franklin, president of the U. S. Lines and the International Mercantile Marine Co. has been elected a director of Pan American Airways.

MEET-BOSS: Arthur L. Lawrence will be contest director at the National Soaring Meet which opens at Elmira, June 24. Advance entries promise the biggest and best meet yet.

ON LOAN: Ben O. Howard borrowed from United Airlines has been busy in Santa Monica testing the DC-4 and the DC-5. The DC-4 was due to be turned over to the airlines late last month.

TRAVELING SALESMAN. Carl B. Squier, vice-president in charge of sales for Lockheed has left for a demonstration flight with the new Lockheed-14 to Latin America.

ALSO PAN AMERICAN: Thomas A. Morgan, president and director of the Sperry Corporation has likewise been elected a director of Pan American Airways

DIRECTOR: Frederick W. Conant, assistant general manager of Douglas Aircraft and a veteran engineer specializing in aircraft construction, has been made a director.

FAIR MAN: G. A. Parsons will be glad to see you from this time on at the Aviation building at the New York World's Fair. He is general manager of U. S. Aviation Exhibits, Inc.

TEN YEAR MAN: W. A. Patterson rounding out five years as UAL president, ten years as organization member, was tendered an anniversary dinner by his staff.

SHOCK STRUTTER: George H. Dowty, head of England's Aircraft Components, Ltd., is on tour in the U. S. to demonstrate his special shock struts as installed on a Ryan S-C.

Factories Sprout in Cal.

Lockheed, Northrop, Douglas get new floor space

WITH Southern California aircraft factories operating at new high levels the month of May found factory expansions still the order of the day. At the Lockheed Aircraft Corp., where 1938 factory additions had brought total floor space to over 330,000 sq. ft., a new overhaul and service building was being rushed to completion. Measuring approximately 160 by 200 ft. in size the new building adds some 20,000 ft. to Lockheed's floor space. About the same amount of floor space is being provided by erection of a new three story wing adjoining the office building at the front of the factory, to provide badly needed executive office space. And while Lockheed continues its factory expansion program on one side of Los Angeles County, the huge Douglas factory balances the area's expansion program by again expanding its physical dimensions in connection with operations of the El Segundo Division. The new Douglas building has a 25 ft. clearance under ceilings and provides an additional 41,000 sq. ft. of floor space.

Meanwhile the new 100,000 sq. ft. factory for Northrop Aircraft, Inc., is being laid out on Long Beach Municipal Airport, and Timm Aircraft Corp. occupies the 52,000 sq. ft. factory on Los Angeles Metropolitan Airport, Van Nuys, that was originally built in 1929 for the Bach Aircraft Company. Total employment of all aircraft factories in the Los Angeles County area, including those plants working on aircraft accessories exclusively, had pushed past the 20,000 mark early in May.

Douglas Nears 40-Million Annual Output; New Models

SETTING a new record for deliveries, the Douglas Aircraft Company completed and delivered $8,177,522 worth of airplanes and spare parts during the period Dec. 1, 1938, April 14, 1939, Donald Douglas, pres., told the annual stockholders meeting on April 19th. Unfilled orders as of April 14th were $32,294,271.20. A unit of ten DC-5 16 passenger transports is now under production, with an order for twelve planes of this model under negotiation. Early orders for the DC-4 were to be anticipated, Douglas thought, as the plane is now through its CAA tests and will shortly be in service test operation on the various airlines. In the meantime the Douglas company is working on the design of a DC-5 four engine plane of about the same capacity as the present twin-engine DC-3. Douglas stated that his company expected to be manufacturing aircraft at the rate of $40,000,000 per year in the near future. Not so very long ago $40,000,000 output per year was not a great way from the figure for the entire aviation industry.

Chamber Steps Out

Sets up aggressive Export Committee to push sales

THE AERONAUTICAL CHAMBER OF COMMERCE of America held the first meeting of its reorganized Export Committee in Washington May 3, and adopted a long term program calculated to protect the industry's foreign trade and stimulate it wherever necessary. John H. Jouett, president of the Chamber, opened the meeting and described some of the export problems confronting manufacturers of aviation equipment. John M. Rogers, vice president of the Douglas Aircraft Company, was elected permanent Chairman of the Committee.

During the all-day session it was agreed that steps should be taken looking to the organization abroad of regional and country advisory committees comprised of factory representatives, the activities of these committees to be closely coordinated with those of the Chamber's Export Committee.

For the purpose of having a record on the economic importance of aviation exports the Committee agreed that members be asked to report to the Chamber periodically the percentage of their gross business classified as export, and the amount of domestic employment accounted for by their exports during a given period.

The Committee also decided to set up an export financing

SOLAR DOUBLES—its operating floor space by the construction of a new building at its San Diego factory site.

RYAN BROKE GROUND—May 1st for a brand new $150,000 factory on west side of Lindbergh Field. Factory floor totals 560,000 sq. ft.

BEECH ORDERED—a new administration building from the Austin Company to house management and engineering departments.

committee for the purpose of studying that branch of foreign trade. One of the first jobs of the sub committee will be to learn the attitude of commercial banks relative to discounting without recourse of foreign paper. The Committee agreed to work for a change in the policy which now prohibits the Federal Export-Import Bank financing items on the "Control List" which includes aircraft. The Committee wants the policy changed so that facilities of the Bank may be used to assist the sale of aeronautical products in countries south of the United States.

Another recommendation of the Committee covered airworthiness certificates for all plane and engine exports, including used planes and engines. The Civil Aeronautics Authority will be asked to establish an expeditious procedure for certifying as airworthy all new or used equipment.

All the Chamber's member organizations have been invited to have a representative on the Export Committee.

Lockheed Strides Ahead

Squier starts on long sales tour of Latin America

WITH employment, production, and backlog of unfilled business all at record levels, Lockheed Aircraft Corporation recently launched a major sales campaign for future business. Close upon the heels of a nation-wide demonstration flight with a new Lockheed 14 equipped with built-in leading edge slots, Carl B. Squier, vice president in charge of sales, took off with a crew of three men in a Lockheed 212 military fighter for an extended tour of nearly fifteen countries of South and Central America.

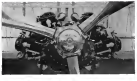
At the same time president Robert E. Gross announced further details of the new Lockheed "Excalibur" four engined transport which is currently being offered for airline service throughout the world. An official statement concerning the "Excalibur" said that commercial deliveries were expected to be made during 1940. The plane will be of low-wing all-metal construction, with tricycle landing gear. Powered with four Pratt & Whitney Wasp engines of 800 h.p. each, the Excalibur will have a top speed of 241 mph and cruising speed of 220 mph with a maximum weight of 27,500 lbs., and a range of better than 2100 miles. The wing span will be 85 ft., length 74 ft. 2 in., cabin length 28 ft., and ceiling height 8 ft. 4 in. Features will include a steerable nose wheel, brakes on all three wheels, improved high-lift flaps, and improved take-off and landing performance.

On his Latin-American sales tour with the 212 military plane, Carl Squier will act as navigator, Capt. E. C. McLeod, pilot, James W. Fisher, radio operator, and Ed Cruz, mechanic. The plane is equipped with a fixed nose gun, a flexible machine gun installed in a revolving rear turret, and with bomb racks. The plane is adaptable for night or day bombing, long-distance reconnaissance, attack bombardment, twin-engine trainer, photographic plane, or personnel transport. Complete with military equipment the top speed is approximately 220 mph, cruising range five hours, and climb to 10,000 ft. in eleven minutes. First demonstration on the tour will be made at Vera Cruz, Mexico. From there the flight will proceed through Guatemala, Salvador, Honduras, Nicaragua, the Canal Zone, Colombia, Venezuela, Ecuador, Peru, Chile, Argentina, Uruguay and Paraguay.

LOCKHEED TAKES A LOOK through $150,000 X-ray eyes

Although official production and backlog figures are no longer released, the Lockheed backlog is believed now to exceed $38,000,000 as of May 1, with employment above 8,000 persons, and deliveries proceeding at the rate of a plane a day. Recent deliveries included two Electras for the Irish Sea Airways operating between Dublin and London, England. At the annual meeting in May all retiring directors were re-elected, and subsequently all retiring officers were reappointed.

In addition to construction of new buildings, Lockheed has recently invested more than $15,000 in new equipment for the x-ray and physical testing laboratory. A 150-ton universal



SURPRISE OF THE MONTH—was the appearance in the General Motors exhibit at New York's Fair of the Allison X8-3420 engine. For over a year it has been Army's prize hush-hush project. Details are lacking, but 2000 horses would be a fair guess as to output.

testing machine, believed to be the largest equipment of this type in use in the aircraft industry, is being used for tensile and compressive strength tests of materials and parts. These physical tests serve to supplement the x-ray testing which is now done on a production basis under the supervision of Triplett and Barton x-ray specialists. Using equipment valued at more than $150,000, all cast and forged fittings used in Lockheed planes are now examined, and their physical properties permanently recorded, by means of x-ray. To date there has not been a single recorded failure of an x-ray part. Monthly Lockheed x-ray film consumption exceeds any other x-ray application industrially anywhere in the world.

California Law Rules Out Sales Tax on Aircraft

CALIFORNIA aircraft manufacturers won a seven weeks fight before the California state legislature with passage of Assembly Bill 272 which removes sales tax liability from all aircraft manufactured in California for the United States government. The bill was signed by Governor Culbert Olsen on May 2nd and became law. A committee of prominent aircraft executives participating in the fight against levying of the state three per cent sales tax was led by A. M. Rochlen, public relations director for the Douglas Aircraft Company. While no tax has been levied against planes sold to the Federal government by California manufacturers, recent decisions in other cases under the existing tax law had made it obvious that the law must be changed to prevent imposition of the tax on the sale of aircraft to the U. S. Gov't.

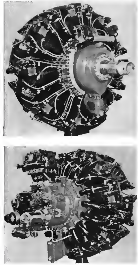
Aircraft Accessories Corp. Buys Siebenthaler of K. C.

TED LYNN, president of Aircraft Accessories Corp., Glendale, Calif., has announced acquisition of ownership and management of the Thomas L. Siebenthaler Manufacturing Company, Kansas City. The Siebenthaler Company has been a leading developer of propeller de-icing equipment, radio devices, and other aircraft accessories. Addition of this firm to the Aircraft Accessories Corp. will greatly expand the scope of its activities in the aircraft accessory field. The Siebenthaler plant occupies two two-story buildings in Kansas City, comprising 14,000 sq. ft. of floor space. The entire plant will be re-arranged, under Lynn's management, and new equipment installed to broaden the activities of the Kansas City factory, which now employs approxi-

mately sixty persons. Headquarters of the Aircraft Accessories Corp. will remain in Glendale, where a line of hydraulic actuating equipment is made.

New Plane Company

FORMED to produce a new type lightweight bi-motor plane of geodetic construction, the North Pacific Aircraft Corporation has been organized in Seattle, Wash., by George Yates, and Allan D Greenwood. While no manufacturing plans have been announced the first plane, known as the Bicraft (see page 40), is now being test flown. The plane is of cantilever low-wing design with retractable landing gear. Power is furnished by two Menasco 50 h.p. engines tractor mounted in wing nacelles. Structure of the plant throughout is of spruce strips wound in geodetic fashion over bulkheads and formers. Accommodations are provided for two people seated in tandem in an enclosed cabin.



NOT TO BE OUTDONE—shortly after Fair's disclosure of another big engine (see page 63), Wright Aeronautical broke news of the long-awaited Duplex Cyclone a double row, air cooled, 18 cylinder radial with a 2000 hp. rating. It has 4 more cylinders, 500 more horses than its predecessor Double-Row Cyclone 14. First installation was in Consolidated's long range flying boat (page 38).

Four Per Day at N. A.

QUIETLY building airplanes at an unprecedented peace-time rate, North American Aviation, Inc., Inglewood, Calif., reported sales aggregating $6,076,694 for the quarter ending March 31st, last, compared with $973,441 for the like 1938 period, and a backlog as of March 31st of $20,645,739. Net profits for the quarter were $1,355,652 after all charges equal to approximately 39 cents a share on stock outstanding. Production is currently at the rate of approximately four planes per working day, with heaviest production concentrated on the basic trainer model being delivered to England.

Six Hundred Workers

A NEW 200,000 sq. ft. factory will soon arise to triple the facilities of the Allison Engineering Division of General Motors Corporation, at Indianapolis, Ind. Six hundred workers (a 100 per cent increase) will produce Allison high speed, V-type, 12 cylinder, liquid-cooled motor, and a new 24-cylinder model the exhibit of which at the General Motors display at the New York World's Fair aroused considerable interest.

Gains Security

AMERICAN AIRCRAFT Co. has been formed to take over the assets of the Security Aircraft Corp., of Long Beach. The new company will have an authorized capitalization of 600,000 shares of preferred and 500,000 shares of common stock, both of $1 par value. Security Aircraft Corp. is to receive 138,651 shares of common stock in return for its assets, which consist chiefly of the Security Airster folding wing monoplane and the Security engine with which it is powered, both designed by W. B. Kinner, president of Security Aircraft, and of the new firm.

Expanded Expansion

THE MAY ISSUE OF AVIATION reported that the Vought-Sikorsky unit at Bridgeport, Conn. would have its area expanded by 4,000 sq. ft., plus an additional building of 430 x 150 feet. Since then a new contract has been awarded to increase the size of the new addition to 450 x 250 feet. With the enlarged addition the total construction cost will approach $350,000. The added space, too, will necessitate the purchase of more equipment, and will probably push the completion date forward to August 1st, instead of July 16th, as originally planned.

Grumman Backlog

WITH two new contracts for airplanes and parts totalling $1,562,838 securely tucked in its backlog, Grumman Aircraft Engineering Company's unfilled orders amounted to $3,635,000 as of April 30. Deliveries for the first four months of 1939 were $1,755,474, against $1,416,460 for the 1938 period, a gain of 24 per cent.

To Build Plant in West

IMMEDIATE construction of a $250,000 plant in the Los Angeles-Burbank area by the Cleveland Pneumatic Tool Company has been announced by James L. Beebe, president of the Los Angeles Chamber of Commerce, following receipt of a wire from L. W. Greve, pres. of the Cleveland concern. The new factory will be erected on a 10-acre tract in the city of Burbank and will specialize in the manufacture of airplane parts, landing gears, and other pneumatic tools.

Howards for Export

MAKING a strong bid for the export market, Howard Aircraft of Chicago has introduced two new versions of the DGA, and has revised its foreign marketing plan. The DGAs 15PC and 16WC have been modified in certain detail to enhance their value as passenger and cargo carriers in out-of-the-way places. They are adapted to wheel, float or ski landing gears. They are fitted for ambulance or photographic purposes. On the P series the engine is a P & W Wasp Jr. of 450 hp. On the Ws, a 350 hp. Wright Whirlwind is standard. Both models swing Hamilton Standard controllable props. At additional cost, full equipment for night or blind flying is available. The former plan of marketing through an export agency has been dropped, and in the future, Howard airplanes will be sold abroad by an export division of the Aviation Manufacturing Corp.

New Stinson Staff

AVIATION MANUFACTURING CORP. announced two important additions to the staff of the Stinson Division at Wayne. Robert R. Osborn, ex-chief engineer for Curtiss Wright at Buffalo, and well known to AVIATION readers, goes in as chief engineer. Lewis E. Reisner, former vice-president of Kreider-Reisner and Fairchild at Hagerstown becomes works manager.

FINANCE

Brewster Stock Offered

THROUGH Van Alstyne, Noel & Co., 72,519 shares of capital stock of Brewster Aeronautical Corporation, Long Island City, are listed on the New York Curb Exchange at market. This represents the unsubscribed portion of an issue of 99,325 shares offered to stockholders to provide additional working capital, needed for new contracts. Of the 72,519 shares offered, 50,000 shares were purchased by Van Alstyne, Noel & Co., who report that substantially all of this amount has been sold, and the remainder are to be acquired by them under a 90-day option. The outstanding capitalization will consist of 446,625 shares of $1 par value capital stock of a total of 700,000 authorized.

» AERO SUPPLY MANUFACTURING CO. INC., for quarter ending Mar. 31, 1939, net income of $16,800, equal after Class A dividend requirements to 3 cents each on 412,491 Class B shares. Compares with $33,500 or 7 cent each on Class B shares for same period last year. Change in par value of the stock from no par to $1 par was approved.

» AIR ASSOCIATES, INC., for six months ending Mar. 31, 1939, net profit after provision for Federal income taxes, $19,953. Total surplus as of Mar. 31, 1939, $652,459.

» AVIATION CORPORATION AND SUBSIDIARIES, for quarter ending Feb. 28, 1939, net loss of $426,290, compared with net profit of $149,439 for same period last year. During the quarter the company was under heavy engineering and development expense for construction of new planes and equipment, the report pointed out.

» BENDIX AVIATION CORP. declared a dividend of 25 cents a share on the common stock, payable June 1. Last payment was a similar amount in December, 1937.

» CURTISS-WRIGHT CORPORATION, for quarter ending March 31, 1939, net profit of $1,898,157, equivalent, after depreciation and taxes, to $1.47 a share on 1,159,484 Class A shares. Compares with profit of $733,910 or 63 cents a share for the like 1938 period.

» FAIRCHILD AVIATION CORP. for three months ending Mar. 31, 1939, net earnings of $56,254 (subject to adjustments and not including profits tax), equal to 19 cents each on 337,032 common shares. Compares with $38,432 or 11 cents per share in same period last year. Unfilled orders; $1,113,284 against $1,070,338 as of January 1, 1939.

» NORTH AMERICAN AVIATION, INC., for three months ending Mar. 31, 1939, net profit of $1,355,952 (after tax provision), against net profit of $212,095 for same period in 1938. Equals 39 cents each on 3,435,033 capital shares, against 6 cents per share in the 1938 period. Sales of $6,078,694 in the period compared with $973,441 in the 1938 period. Unfilled orders at Mar. 31, 1939 amounted to $20,945,740.

» PAN AMERICAN AIRWAYS CORP., for year ending Dec. 31, 1938, net income of $49,872, equal to 3 cents each on 1,409,800 shares; for 1937, net income of $510,417 or 38 cents a share. Current assets, $2,415,700; liabilities, $3,758,933. Gross revenues were $16,072,952, a gain of nearly $1,500,000 over 1937. Expenditures for 1938 included $2,050,000 for current acquisition of new flight equipment and ground facilities, and $84,981 deposited against new aircraft for future delivery.

» UNITED AIRCRAFT CORPORATION AND SUBSIDIARIES, for quarter ending March 31, 1939, net profit of $1,490,790, equivalent to 59 cents per share on 2,649,437 shares of capital stock after provision for Federal and Canadian taxes, and minority interests in the profits of the Canadian subsidiary. Compares with profits of $1,072,299 or 42 cents each on 2,531,493 shares of common stock for the like period of 1938. Total sales for 1939 quarter, $9,627,565. The company declared a dividend of 75 cents per share on the capital stock, payable June 15.

WACO AIRCRAFT COMPANY for six months ending Mar. 31, 1939, net loss of $12,520, against loss of $31,438 for the same period in 1938.

» WRIGHT AERONAUTICAL CORPORATION, for quarter ending March 31, 1939, net profit of $1,231,725, equivalent, after depreciation, interest and taxes, to $2.05 a share on 599,957 capital shares. For the same period in 1938 net profit was $598,298 or 98 cents a share.

Institute at Elmira

MAJOR LESTER D. GARDNER, Secretary of the Institute of the Aeronautical Sciences, announces a meeting of that organization to be held June 30 and July 1 at Elmira, New York

The meeting will be held in conjunction with the Soaring Society of America during and in connection with the Tenth Annual National Soaring Contest which will be held from June 24 through July 9, in Elmira, New York

F. W. HERMAN

Douglas Names New Chief

F. W. Herman to head engineering at Santa Monica

APPOINTMENT of Fred W. Herman as chief engineer of the Santa Monica Division of the Douglas Aircraft Company has been announced by Major Carl A. Cover, senior vice president and general manager, and Arthur E. Raymond, vice president in charge of engineering. Mr. Herman has been assistant to Mr. Raymond since 1935 and is particularly well known for his work as project engineer on the original Douglas DC-1, and the first DC-2. Mr. Herman left the University of California to serve in the artillery and Air Service during the World War, completing his pilot training at Kelly Field, Texas. He graduated from the University of California in 1921 with the degree of Mechanical Engineer and served in the engineering division at Wright Field from 1921 to 1929. In 1928 he came to Los Angeles as chief engineer for Moreland Aircraft Co., and in 1930 he joined the Douglas organization.

With Mr. Herman in charge of all Douglas engineering at the Santa Monica plant, and Edward H. Heinemann holding a similar position with the Douglas El Segundo Division, Arthur E. Raymond assumes the title of vice president and Director of Engineering, and will devote his efforts to general supervision and coordination of all engineering activities.

New Size Uni-Twins

FURTHER DEVELOPMENT of the Unitwin type powerplant is provided for in a contract recently negotiated between Menasco Manufacturing Company and Vega Airplane Company. The present Unitwin consists of two Menasco CSS-4 engines geared together through free-wheeling units to develop a maximum of 580 h.p. Under the new contract the Menasco Manufacturing Company will undertake to develop Unitwin units of both greater and lesser horsepower than that of the present model, as may be required by Vega Airplane Company. All manufacturing rights covering the Unitwin free-wheeling principle are the property of Vega Airplane Company, but a cross-royalty agreement covers use by Vega of engines other than Menasco, and sale by Menasco of Unitwin powerplants to aircraft manufacturers other than Vega.

According to information carried in a prospectus recently issued by the Menasco Manufacturing Company, an option has been taken on a new foundry technique known as the Antioch process and covering the casting of non-ferrous alloys. This process provides for casting to very close limits, resulting in castings of superior quality which it is believed will find application in aircraft manufacturing.

Davis Low-Drag Wing

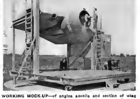
A PROMISING NEW AIRFOIL DEVELOPMENT has been announced by David R. Davis, of Los Angeles, independent aeronautical engineer who was at one time associated with Donald Douglas in the early days of the Douglas Aircraft Company. The Davis airfoil has been subjected to considerable wind tunnel testing, but is currently attracting most interest because of its use on the new Consolidated Model 31 twin-engined flying boat (see page 58). Much of the sensational performance being credited to the Model 31 is said to be a result of the favorable qualities of the new Davis airfoil.

Original wind tunnel testing of the Davis airfoil was performed at the California Institute of Technology, and a further test program is now being conducted at the new University of Washington wind tunnel. Numerous comparative tests are reported to have been made against wings using conventional airfoils. The result has been to show the Davis airfoil to have a very high slope lift curve, developing its lift at relatively low angles of attack, a relatively low drag curve, and a stable center of pressure. Most noticeable physical characteristic of the Davis airfoil is the reflex nature of the curve, obtained largely from the convex shape of the lower surface. Development of the Davis airfoil is said to result from a new mathematical formula developed from an extensive study of the rotor lift theory. The shape of the airfoil may be varied through changes in the formula to produce wing sections of desired characteristics, and it is reported that for each upper surface curve so developed, a corresponding lower surface curve is produced to complete the airfoil. Davis is offering an airfoil engineering service to interested manufacturers on a royalty basis.

DC-5 FINISHES TESTS—as rumors fly of probable purchase of 4 for Dutch Airlines KLM

Harvey Mummert

A VETERAN PLANE DESIGNER died at Hammondsport, N. Y., on May 3. In 1922, Harvey Mummert designed the Mummert, with a wing spread of 18 ft., overall length of 12 ft., and a total weight, including pilot, of 550 lb. In 1925 he designed the Aerial Mercury, a biplane designed for night air-mail service. He was formerly with Curtiss-Wright Airplane Company and at the time of his death was vice president and chief engineer of Mercury Aircraft Company, Inc. of Hammondsport. Mr. Mummert participated in many air races, and air tours.



WORKING MOCK-UP—of engine nacelle and section of wing give Glenn Martin engineers a chance to give power plants a thorough work-out on the ground, shortening final test time, saving dollars, reducing insurance premiums.

Frye, Richter, Hughes Buy TWA Control; Run School

LATE in April, it was announced, that a group headed by Jack Frye, president of TWA and Paul Richter, executive vice-president had purchased the entire holdings of Lehman Bros. and its associates in that airline. About a fortnight later, a report filed with the S.E.C. revealed that Howard Hughes had apparently financed a large part of the deal, purchasing 99,293 shares of TWA stock through the Hughes Tool Co., a block corresponding to approximately 12 per cent of outstanding shares. Concurrent reports placed the stock owned jointly by Jack Fry and Richter at another 6 per cent. Just how effective a working control this 18 per cent total will give this group is unknown, but it does substantially increase the share of the management in its influence upon the finances of the company. The deal is understood to have been consummated at a price of $2.00 per share above the market quotation at the time of sale or approximately $9.00 per share.

In a joint statement Frye and Richter said, "The members of the TWA management identified with this purchase have been actively engaged for 15 years in air transportation and in the development of this company. The acquisition of this interest is the realization of a hope which we have entertained for many years."

"TWA's high standard of service to the public will, as in the past, be constantly improved, and policies which have been followed since the inception of the airline will, of course, be carried on."

"In this connection we are announcing, as of May 1, the second major expansion of our service this year, bringing the total seat miles operated per month to more than 17,000,000, the largest we have ever operated. At the same time we are speeding up the coast-to-coast run of the TWA "Sky Chief", which has always been the fastest flight operated by any airline between New York and the Pacific Coast."

"We deeply appreciate the friendly cooperation of the Lehman Brothers in working out the details of this purchase. Lehman Brothers have given valuable financial counsel to TWA in the past, and will continue to act in this capacity."

SENIORS AT TWA HIGH
Twenty per cent changed ambitions

TWA National Air Youth Project

Stock dealings, control transfers and schedules boosts, however, were by no means the sum total of TWA headlines since the last issue of Aviation. TWA somewhere found the energy also to undertake an extremely original experiment in education. It all started, it seems, when Paul Beck of the Crowell Publishing Co. let fall a remark at the recent NAA conference in Washington about the value to the future of air transport educational program amongst the nation's current school children. Generally such suggestions are gone with the wind. But in this case Jack Frye was sitting in the audience and was set to thinking about the idea. Working with the Crowell Publishing Co. and Clinton Hester of the C.A.A., Frye decided to run a test on such a project at Albuquerque, New Mexico. With the cooperation of the local educational authorities he sent pilots and other personnel into the town's high schools to give talks on air transport in its various phases. Then, beginning April 24, TWA started taking up all of the students in the town who could get parental permission. During the following week thirty-minute flights in a new DC-3 skyclub were given to 1,816 boys and girls from the Albuquerque High School, to 144 additional students from Parochial schools, and to 81 instructors.

As a result John Milne, superintendent of schools, commented, "In my opinion, the half hour rides and the class lectures determined the future vocation of about twenty per cent of the Albuquerque High School student body." The school board decided to establish an aviation vocational course. Frye and Beck were so enthusiastic that it was indicated TWA would extend the program to other cities along its transcontinental routes next fall.

Traffic Meanwhile is Climbing

TWA reports an increase of 13 per cent in its passenger mile record for April over the same month a year ago. The airline flew 9,884,710 passenger miles during the month. Airmail showed a 15 per cent increase over 1938 and air express was up 35 per cent.

MAINTENANCE

Shatto New Chief For Braniff Airways

EFFECTIVE May 1, Stanley Shatto, Dallas became superintendent of Braniff Airways' maintenance department to succeed Reagan C. Stunkel who is resigning to accept a position with Lockheed Aircraft Corporation.

Shatto, though only 30 years old, is a veteran airline engineer. Born in Reger, Missouri, he broke into aviation in 1926 with Robertson Airlines of St. Louis, Missouri. Following periods of employment with American Airlines, U. S. Airways and Pennsylvania Airlines he joined the Braniff organization exactly four years ago as engine overhaul superintendent. For the past year he has been assistant to Stunkel.

After a brief vacation Stunkel will join the Lockheed organization at Burbank, California. He will be directly responsible in an advisory capacity to Mac Short, president of the Vega Airplane Company, Lockheed subsidiary, but on assignment will also serve the Lockheed company and Menasco Engine Corporation.

STANLEY SHATTO

American Opens School For Apprentice Mechanics

AMERICAN AIRLINES announces the opening of a mechanic school. Sixty young men have signed contracts with the company which will pay them salaries while they attend an apprentice training school in the company's shops and at its various air stations. During this time they will be passed through an exhaustive curriculum; fourteen months will be spent on daily and major engine inspections, general aircraft repair, accessory and engine changes, and propeller checks, eleven months on engine, propeller, and accessory overhauls, one month in the supply department; three months in the engine installation department, two months in the instrument overhaul department, and six months in the airplane overhaul department. At the end of the course the apprentice mechanic will be eligible to take CAA examinations for any certificates necessary for the particular type of work

THE CONTROL TOWER

by DAN SAYRE

Survey Proves Traffic Men Are Tops

We have two bouquets this month to pass along to American Air Transportation. The first is planted in a release from Air France describing the new equipment they are now operating on their air line. "The Air France fleet includes the most modern type of land and sea planes which assure the American traveler *the same comfort and security to which he is accustomed at home!*" . . . . The second we pick up from The May 13 issue of Railway Age. A certain James R Ozanne, merchandising and personnel counsel reported recently to a sales meeting of railroad passenger traffic men at Chicago on the results of a survey he had just completed. Setting an index of sales efficiency as an average of eight factors involving appearance, alertness, courtesy, etc, he rated retail lumber yards at 70, department stores at 75, restaurants at 77, railroads at 72, laundries and dry cleaners at 81, grocery stores at 84, hotels at 84, filling stations at 89 and air lines at 91. Oh Boy!

The Supreme Court of Florida set an important precedent last month when it ruled that Pan American held full title to its Dinner Key base, which had been purchased under condemnation proceedings after its owners had declined to sell. It seems Pan American leased the property in 1930 for 50 years. Then, when expansion became necessary, sought to purchase it but was unable to agree with the owners. The state condemnation law was then evoked and a jury fixed the price at $135,000. Railroads have long had this privilege to take land by "eminent domain". If air transport is now to have such privileges it will help solve many a critical airport problem.

Pan American Airways engineering and operations men used to be harder to get stories from than anyone else in the industry. Now, we understand it's going to be easier. Reason is a large number of developments for which Pan American feels it can properly claim credit have been turning up abroad as brand new products of the genius of this and that nation's air lines. Examples: Floating piers and loading platforms, marine lighting systems for after-dark landings and take-offs by flying boats; the two deck engine work stands, even the ceremony of ringing one bell for the flight crew to go aboard then two bells for the passengers.

The Air Safety Board has sent us a release starting out: "Engines, like cats, keep purring if they are treated well, and if abused, someone is likely to get hurt. A sputtering engine, however, can cause a great deal more damage than a spitting cat. Yet there are those who will abuse an engine by neglect until it reaches the sputtering stage and then finally quits. . . ." It then goes on to deliver some excellent advice on the value of keeping engines in tip-top shape. It is aimed at the non-airline operator rather than at maintenance personnel, but it is interesting if only for its literary style.

"Only Angels Have Wings" is the latest "air transport" offering from the stew pots of Hollywood. Confidentially, it stinks. There is a good juicy land crack-up every reel. There is all the old tripe about hard drinking airmen who have flat fights over questions of "guts". There is that old business about having to make such and such a flight by such and such a date to keep the franchise. There is a brand new one about a condor crashing through the windshield and killing the co-pilot. Since the scene of these alleged air line doings is laid in the Andes, Panagra ought to sue. What have we ever done to Hollywood anyhow?

(Continued from page 69)

in which they have specialized. T. J. Healy, former supervisor of maintenance at Cleveland for American will supervise the school.

Requirements for enrollment are: American citizenship, a high school diploma or its equivalent, passage of a physical examination, attainment of legal working age. The maximum age limit is 25 years at date of enrollment. No further applications will be accepted for the course for another eight or ten months.

OPERATIONS

CAA Sets Up Three Traffic Control Centers

Three new airway traffic control centers were put into operation on May 1st at Fort Worth, Tex., St. Louis, Mo., and Salt Lake City, Utah. Addition of these stations will increase the annual number of controlled aircraft movements to 1,610,000 and will increase the airways under direct supervision of the CAA traffic control operators to 10,995 miles, or approximately 45% of the total of 24,011 miles covered by the Civil Airways system.

The St. Louis Station, controlling 730 miles of civil airways in the midwestern part of the country, will handle upwards of 51,200 aircraft movements each year and at Salt Lake City, the control center for 1,530 miles of airways, 27,300 movements will be handled annually.

The Fort Worth operators, supervising 1,240 miles of airways, will handle more than three times the volume which will be handled at St. Louis, and six times as many aircraft movements as the Salt Lake City station. It is estimated that at least 166,000 aircraft movements will be controlled from Fort Worth because of the activities of the several scheduled air lines operating in the southwest as well as the large volume of private and military flying which is concentrated in that area.

At present there are eight airway control centers in operation on the civil airways, located at Newark, N. J., Detroit, Mich., Chicago, Ill., Atlanta, Ga., Burbank, Calif., Oakland, Calif., Washington, D. C., Cleveland, Ohio, and Pittsburgh, Pa.

One of the newest forms of aid rendered aerial navigation by the government, traffic control is by no means the least.

TRAFFIC

American

American Air Lines carried 35,709 revenue passengers during the month of April, according to vice-president Charles A. Rheinstrom's report, an increase of 63.5 over April a year ago. Revenue passenger-miles flown during April totaled 14,030,748, a gain of 32.4 per cent. May 1st, American added two round trips between New York and Boston and one between New York and Los Angeles, Chicago and Detroit.

Braniff

Braniff Airways passenger traffic during April showed an increase of 47.2 per cent over April of last year, Charles E. Beard, vice-president of that line, has announced. Braniff's Chicago - Dallas operations showed a 37 per cent gain for the month; Braniff's Texas routes showed an increase of 57.1 per cent. Traffic during May was expected to hit an all-time high.

Eastern

Eastern Air Lines in April carried 17,950 passengers, an increase of 26 per cent over April, 1938, according to Capt. E. V. Rickenbacker, president and general manager.

United

United Air Lines logged 20,445,-728 revenue passenger-miles during the first three months of 1939 to establish an increase of 26.8 per cent over the corresponding period of last year.

AIR TRANSPORT INDICATOR

May 1, 1939

125.23

Which is the ratio of the passmiles reported by the Air Transport Association for all domestic lines for April, 1939 to the figure for April, 1938.

Trends for the year continued excellent. For the first four months, traffic stood at 157,-478 415 pass-miles—up 25.2 per cent.

AVIATION OPERATORS CORNER

DR. WOLFGANG B. KLEMPERER, president of the Southern California Soaring Association, speaking at dedication of the Kern-Mesa soaring site.

20,000 at Soaring Meet

Twenty soaring planes and fifty pilots dedicate Kern-Mesa site.

Hampered by lack of wind or thermals, the second annual gliding and soaring meet staged at Arvin, Calif., by the Southern California Soaring Association resulted in much public interest, wide participation, and some notable performances. Continuing through two week-ends, April 7, 8 and 9, and April 14, 15, and 16, the Arvin meet served to formally dedicate the new Kern-Mesa soaring site.

Approximately 20,000 people gathered to witness the recent meet. Some twenty soaring planes, all of American design and construction, and approximately fifty soaring pilots participated. Events included spot landings, bomb dropping, altitude, distance, and distance and return flights, as well as duration. Longest official flight of the meet was three hours and 48 minutes by Woody Brown, of San Diego, although much longer unofficial flights were made. John Robinson won the altitude trophy with a flight to 4,000 ft. above point of release. Dick Essery won the distance and return trophy with Lucretia Buxton as his passenger. Lucretia Buxton, only woman soaring pilot at the meet, set an unofficial soaring mark with passenger by flying to an altitude of more than 5,000 ft. She also carried a CBS announcer, Paul Pierce, in her father's two-place "Transporter" on a flight from which a short wave broadcast was re-broadcast over an international hook-up, and later carried AVIATION's representative as a passenger for photographic purposes. Trophies for spot landings or bomb dropping were won by Speed Westphal, Franklin Wolcott, Bob Heidemann, Walt Heidemann, Gus Briegleb, Walter White, and Howard Morrison. Woody Brown won the western soaring championship and the Hawley Bowlus trophy by scoring the most total points at the meet.

Soaring events in prospect this spring and summer include the American Open Soaring meet on the dunes at Frankfort, Mich.—August 26-September 4, and the Second Annual Southwest Soaring Contest at Wichita Falls (Tex.) Municipal Airport, June 4-11. The Michigan meet is sponsored by the Frankfort Soaring Association and the Texas contest by the Wichita Falls Junior Chamber of Commerce.

In joint exercises by the City Commission, the Junior Chamber of Comerce and the University of Alabama, the Hargrove Van De Graaf Airport at Tuscaloosa, Ala., was dedicated May 9. The 256-acre airport and combination terminal, hangar and office building constitute a WPA development representing an investment said to exceed $200,000.

You must be 18 years old to receive your private certificate according to a recent C.A.A. ruling raising the age from 16. This doesn't raise the 16-year qualification for student permits, but simply prevents pilots from carrying passengers until they are 18. Among those awaiting clarification of the new regulation is Charles Sharp, 17 years old, of Fairfield, Conn., who learned to fly at 16 and now has 150 hours in the air. Whether he will be deprived of his right to carry passengers until he reaches the age of 18 is a question.

Seven committees have been appointed by the Private Fliers Association according to a recent announcement of A. R. Stevenson, president. They are: *Regulation*—A. R. Stevenson, Jr., Chairman, Dr. Irving Langmuir, Richard Dalton, Mr. Deines, William Rochford.

Airports — Robert Aldrich, Chairman, George B. Post and A. H. Near.

Safety—F. T. Kurt, Chairman, W. L. Jack Nelson, Leighton Collins, Jerome Lederer, W. R. Enyart and Wm. W. Brinckerhoff.

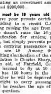
Radio—Roger Wolfe Kahn, Chairman, David Little, Herbert Fales.

Education—W. R. Enyart, Chairman.

Membership—Wm. W. Brinckerhoff, Chairman, Henry King, Frank W. Fuller, Jr., Moss Paterson, Jerry Fairbanks and Robert Donner.

Legislative—To be announced later, handled meanwhile by the President, Secretary and General Counsel of PFA with help of special members.

The Noisy Birdmen are all set for their air meet scheduled for May 28, at Bellanca Field, New Castle, Del. Events were to begin at noon with a mass flight over New Castle and Wilmington and end with formation flying by the New York National Guard. Also on the program is a cross country race to Dover, glider demonstration, a light plane race, a free-for-all, and a consolation race. Bomb dropping, paper cutting, spot landing and other contests are scheduled. Demonstration flights by W. A. McCurdy, Harold O. Swift, and others are on the program.



NEW JOBS: Miss Jewel T. Puckett has been made secretary of the Florida N.A.A. Division.

PRESIDENT. Carl I. Friedlander is now president of the Aeronautical Corp. of America.

Hylan Flying Service, Inc., Chili, Monroe Co., N. Y., has been chartered by the Secretary of State with capital of $50,000 to conduct a school for teaching aviation and flying. Roy P. Hylan, Jean E. Hylan, Henry Redman Dutcher, of Rochester, are directors and subscribers. Dutcher is also attorney for the corporation.

Dewey Does it Again

Eldred Sets New Closed-Course Record for Sea-

Dewey Eldred hung up another record when he completed 10 laps over a 2,000 km. (1242-mile) course in 16 hr., 56 min., and 32 sec. His ship, owned by the Lubri-Zol Corporation, of Cleveland, was as usual a Taylorcraft seaplane powered with a 55 hp Lycoming engine. The flight was completed shortly after midnight, Saturday, April 22, at Fire Island Lighthouse,

RECORD BREAKER: Dewey Eldred has just set a new closed course mark in a Lycoming powered Taylorcraft.

Bayshore, L. I., Average speed was 73 26 m p h. N.A.A. Timer William C Zint asserted that the flight constituted a new record in the second category for seaplanes with less than 337 cu.in displacement

Load at take-off was 1402 lb., of which 444 was gasoline, 8, oil, and 20, extra equipment consisting of wobble pump, gas lines from floats, and a battery Two gallons of gasoline and 4 of the 5 qts. of oil remained after landing

Recommendations on Boston Airport of the Special Recess Commission of the Massachusetts Legislature are Formulation of a state policy for the Boston Airport as soon as the Federal participation in airport construction and operations of airports is clearly defined Then the Commonwealth should work out an arrangement of control and management of the Boston Airport.

A base of three per cent of the gross revenue from operations at the Boston Airport should be established for all future operating leases, and the Commonwealth should immediately determine a fair rental to be paid by the city of Boston for use of the land of the Commonwealth as provided in existing leases

Adequate zoning of future structures surrounding the airport should be set up and the Commonwealth should relinquish its right of way along the southerly and southwesterly portion of the airport.

Figures were presented by the Commission to show the economy of operation to be found if Boston is made the western terminus of a transatlantic service.

In 1938 operators at the Boston Airport did an estimated gross business of $3 000,000. Boston received $11,800 in leases and spent $50,000 for operation, leaving a deficit of $38 200. The airport represents a $10,000,000 investment on the part of the State, City and Federal governments

Faster financing is now offered by Aviation Funding Corporation, which has merged its interests with Bankers Commercial Corporation, the oldest time-payment finance company in the United States Announcement of the merger was made recently by Gordon M. Curtiss, president. Advantages attributed to the new organization are: long experience in all phases of aircraft financing, services of a 35-year-old finance company, resources of over $17,000,000 Policies, scope and methods of operation are sketched in a booklet which is available to those interested

Distributors can sell their trailers and dispose of their delivery problems and use their time for more and better selling. All you need do is wire Reliable Flyers Inc. at Neuvoo, Ill., and your ship will turn up from the factory in a few days. President of Reliable is Leonard J. Schrader who runs a school at Neuvoo Graduate pilots of the school will make the deliveries Pilots will be bonded and planes insured. Tariffs on light planes from every factory to every approved airport soon will be published by the company.

TAGGING THE BASES

with LES NEVILLE

C.A.A. Cuts C.A.R.

Increased payload for all training planes has resulted from a recent constructive move by the Private Flying Division of the C A A No longer will it be necessary for students to tote around the Sears Roebuck-catalog-sized version of the Civil Air Regulations. The new abridged edition contains everything a pilot should know about C.A A. and it is only 55 pages in length. Readers of this department will remember we suggested a more compact version of C.A R. about a year ago and we want to be among the first to congratulate the C.A.A. on this important contribution But let's not lose sight of the fact that there is still a major job to be done in clarifying the regulations so each pilot doesn't have to carry a lawyer around in his pocket when he flies.

Down at Langley Field our old friend Eastman Jacobs and his gang in the Variable Density Wind Tunnel told us a little about a remarkable new wing section that had about one-third less drag than most others. That's an engineer's way of saying there's increased performance available without paying for it in higher horsepower. Maybe this is an opportunity for the small plane manufacturer to get some increased performance without going to bigger engines This means dollars and cents to the manufacturers and operators as well Let's watch the N.A.C.A. closely on it.

For years we have been griping about signs around airports and objecting to the pains some towns take to hide away their flying fields so no one can find them We had just about reached the point where we were going to decide that they were ashamed of them when we happend to drive through Baltimore. There on almost every telephone pole is a neat marker, with an airplane silhouette pointing the way to the field Other cities please copy

There has been some grief suffered by airport-ambitious communities when they had to change their plans to conform with the requirements of the C A.A. Airports Division Most of it could have been avoided if they had consulted with C.A.A first. The Authority has a collection of regional airport engineers who know a lot about their business. If you are planning an airport why not look up your local man and get his advice before going too far ahead!

More than 250 licensed airmen and luminaries of the Southern California screen and aviation industries jammed the Rainbow Isle banquet room of the Mayfair Hotel, Los Angeles, to the gills on May 20th, to help the Licensed Airmen of America celebrate their fifth Anniversary, as well as the twelfth anniversary of the start of Lindbergh's flight to Paris James Stewart, air-minded moving-picture star, served as master of ceremonies for the evening, with numerous items of entertainment furnished by moving picture people.

Five western universities and colleges participated in what was announced as the largest intercollegiate air meet yet staged on the Pacific Coast, held May 13th at Los Angeles Metropolitan Airport, Van Nuys. Conducted under the sponsorship of Alpha Eta Rho, national aviation fraternity with headquarters at the University of Southern California, the contest drew flying teams from Stanford University, University of Southern California, University of California at Los Angeles, San Jose State College, and San Diego State College Twenty-four college pilots, including three co-eds, participated in a program on spot landings, bomb dropping, and stunt and precision flying.

BIGGER AND BETTER: Hayden Brooks (left) and Steadham Acker (right) ganging up on City Commissioner Jimmy Jones with plans for the Tenth National Air Carnival at Birmingham, Ala., June 2 3, 4.

REPORT CARD

Of Air School

A new engineering building is going up at Parks to accommodate on increasing number of students. Two rooms, each 44x27.5 feet and each containing 40 individual drafting tables will be provided. Non-glare fluorescent lighting is specified for these two rooms. To increase the usefulness of the rooms, lecture platforms and blackboards are to be provided. A third room of equal size is to be fitted as a lecture and recitation room, while a fourth will be an engineering laboratory. In the laboratory is to be a concrete base 3x6x6 feet for use in conducting load tests. It is planned to install the most modern equipment throughout the laboratory.

Boeing School scholarship winners of $11,140 in awards made annually by the National Committee of Award of the United Air Lines Scholarships have been announced. Four awards were given, consisting of the Solo Pilot Flying Course, plus their choice of one of the following courses for which the candidates were eligible: Air Transport Engineering, Airline Operations and Engineering, Airline Technician, Airline Meteorology, Airline Mechanic and Operations, or the Airline Mechanic Course. Winners were: J. Louis Cameron, Pullman, Wash.; Richard H. Burroughs, Jr., Princeton, N. J.; Emil Kissel, New York, N. Y., and Stewart W. Dou, Atlanta, Georgia. These Boeing Scholarships are awarded annually for the best treatise on an aeronautical subject by a student regularly enrolled and in good standing in a college, university, or junior college in the United States or Canada. The 1939 National Committee of Award was composed of: Dr. Baldwin M. Woods, University of California; William B. Stout, Stout Research Laboratories; Professor Bradley M. Jones, University of Cincinnati; and A. F. Bonnalie, Ass'n Sup't of Flying, United Air Lines.

The American School of Aircraft Instruments, at Glendale, Calif., enters its Spring semester with a near-capacity enrollment. The school offers a complete instrument training course on meteorology, repair and testing of all instruments, shock mounting, panel design and lay-out, plumbing and navigation. All instruction is under the personal supervision of Gene C DeBaud, Government Approved Instrument Instructor, formerly with the Stinson and Consolidated Aircraft Corporations.

College examinations are complicating the lives of the students learning to fly under the C.A.A. experimental training program. What with cramming at night and flying in the day time, the boys have a heavy load to carry. Although some slump may be expected in hours logged during this period, it is sure to be followed by a rapid acceleration after the trying days have passed.

C.A.A. TRAINING POST: Hangar and flight line at the Alabama Institute of Aeronautics, Tuscaloosa.

C.A.A. Flight Training Log As Of May 10

Name	Quota	Total Hours Logged to Date	Number of Students Soloed	Tests Passed
University of Alabama	30	820	30	
Georgia School of Technology	30	392	22	
Kansas University	20	460	20	
Mass. Institute of Technology	20	282	17	
University of Michigan	20	489	20	
University of Minnesota	20	254	15	
New York University	20	275	15	
North Carolina State College	20	434	19	
Pomona Junior College	15	297	15	
Purdue University	50	1608	30	24
San Jose State College	15	414	15	
North Texas Agri. College	30	678	30	3
University of Washington	30	274	13	
Totals	330	6677	281	27

You can learn soaring in two weeks by taking the courses offered by the Frankfort (Mich.) School of Soaring. Classes begin July 16, July 30, August 13. A four-week course is also offered beginning July 12. Tuition, board and lodging cost for the 2 weeks courses is $140, for the four weeks course, $235.

Two instructors are needed by the Haaren High School Aviation Annex, New York City. The vacancies are for an indefinite period but normally a teaching assignment lasts for at least one semester that is from September 1939 to February 1940. Temporary salary is $12 per diem but those who qualify themselves to take the regular license examinations are eligible for a salary schedule beginning at $2160 per annum to a maximum of $4500. Requirements are high school education, 6 years of journeyman experience in the industry, and certain free teachers' training courses.

Aircraft power plant operation is the subject of a course of instruction by the Webb Aircraft Engine School of Technology at Glendale, Calif. Executive personnel includes D. P. Webb, president; L. L. Webb, secretary-treasurer; and Charles A. Zweng, consultant. Also instructing are James Lambert and George H. Barker; president Webb was associated with the Douglas Company when he resigned to found the school.

Over a thousand books have been distributed by the Tennessee Bureau of Aeronautics to school and public libraries recently. These free books are being supplied by the Bureau without charge, in order that the citizens of Tennessee may learn the very latest and best in aviation.

With all the hell-a-baloo about building up a civilian air reserve for military purposes in full swing as the C A A pilot training program shifts into high gear, an independent civilian pilot training program under way in Southern California is meeting with considerable success. Known as the California Aero Squadron, and sponsored by the Hollywood Junior Chamber of Commerce, the group meets regularly at Los Angeles Municipal Airport. Claiming to be the first uniformed, disciplined, semi-military organization of its kind, the California Aero Squadron is providing non-college boys with basic flight training and rudiments of military drill. It is hoped that similar squadrons may be sponsored in other parts of the country with the aid of Chambers of Commerce in other cities, to eventually bring about a National Civic Air Reserve

HOUSEWARMING:—Recently dedicated was the newer and larger quarters for the Rising Sun School of Aeronautics, at 181 West Roosevelt Blvd., Philadelphia, according to a recent announcement by President Fred Vilsmeier. The new home is a three-story building having 43,000 sq ft. of floor space.

Wings on the Wind

(Continued from page 23)

been the English Slater-Cobb and the German Horn.

In view of the impossibility of combining all desirable characteristics in one instrument, most sailplanes participating in important contests carry two variometers one for precision work and one for prompt indication

As for airspeed meters, the German Askania produced a remarkable instrument in 1938. After many years of combining the use of Pitot and Venturi tubes, Askania has returned to a single Venturi tube type. Accurate speed indication is given from 20 m.p.h. to 125 m.p.h. Greatest precision is obtained in the range between 25 m.p.h. and 50 m.p.h. The diameter of the instrument is 2 in. The Venturi tube is electrically heated to prevent freezing.

Venturi tube turn indicators have generally been recognized as unsatisfactory for soaring flight because they frequently go out (due to ice and water accumulations) at the time when they are most needed, that is, when flying blind in a storm cloud. Very light weight electric turn indicators have therefore been developed which are driven by pocket flashlight betteries and are switched on only when actually needed.

Except in Finland where long winters produce ideal take-off conditions from the ice-covered surfaces of lakes, automobile towing has lost almost all of its popularity. Winch towing is very much in favor everywhere. The complicated, makeshift drum arrangement fitted to the rear wheels of automobiles has generally disappeared and in place has come the modern winch which is generally mounted inside a car beside the driver's seat. A double clutch behind the gear box connects the engine to the rear wheels for normal driving or with the chain transmission on the winch for launching. Winch drums are usually of steel and must be perfectly balanced to avoid vibration. For school purposes, towing ropes are generally ⅛-in. diameter steel cables (84 wires with hemp core) approximately 3,000 ft. long. A safety section is usually inserted in the rope which will break under a tension of 800 lb.

The drum diameter and the transmission are calculated for an average speed of 40 m.p.h. in second gear. First gear is employed only for unusual purposes like pulling a ship up from a valley to a hill-top, or doing other heavy work. Third, or high gear, is used only when it is absolutely necessary to launch a sailplane with a tail-wind, or to wind the rope up rapidly to get it out of the way of a plane which may be landing on the field.

This type of winch was developed in Milan, Italy, and was successfully used at the Olympic Soaring meet in Berlin in 1936. Advantages are obvious, for the winch unit is independent of other launching means and no other car is needed on the field.

Airplane tow-offs are now very popular in Europe and many pilots at several schools have tried to solve the problem of what to do with the towing rope after the sailplane has released it. Normally, the airplane pilot glides toward the field, passes over it at a height of about 100 ft., and pulls his own release to drop the rope on the field. He then has to make another turn around the field in order to land. This procedure can be avoided by pulling the cable inside the airplane, that is providing a small winch inside the ship to retract the towing cable after the glider has cast off. In order not to introduce useless complications, the towing load does not come directly on the winch but is normally taken up through the attachment fittings at the tail of the airplane. The cable release is operated in the usual way but instead of the main cable dropping freely, it is picked up by a short length of cable attached to the release ring and to the winch drum. After pulling the release, the pilot immediately starts winding the cable on board. As this does not require his entire attention, he may be preparing for his landing in the meantime, thus saving the necessity of making a second turn around the field. Time between take-offs is reduced and an appreciable amount of gasoline may be saved. At the same time, the dangers and inconvenience of dropping the cables onto the field, later to be located and re-attached are eliminated.

Due to the interest in modern altitude and distance flights, most secondary schools have gone in for intense blind flying training. The German research center at Darmstadt has probebly gone further in this direction than most schools. A Kranisch two-seat sailplane is used with complete inclosure provided for one of the seats. Courses are usually held during the winter when the air is comparatively calm and when normal soaring activities are at a minimum. An airplane pulls the ship to an altitude of 10,000 ft. and the student pilot then has an opportunity at blind gliding. Where two-seaters are lacking, the same thing may be done with temporary inclosures around the pilot which may be lifted at will.

A great deal of consideration is now being given to safety. It makes little sense that a pilot should be injured in a landing which is simply rough. Safety belts should be wide enough to reduce unit pressures on the body to a reasonable limit and no obstacles should be permitted in front of the legs and knees against which the pilot would be thrown in case of a sudden stop. It is particularly important that the cockpit inclosure be easily detachable. The pilot should be able to open it and possibly throw it away in any possible attitude of the ship. Hinges should not be on one side and the release on the other. In spite of all precautions it has happened more than once that accelerations in a spin or in a tight diving spiral have kept the inclosure from opening to permit the pilot leaving the plane by parachute. The more practical thing is to make hinges detachable so that every hinge can be used as a release.

The year 1939 will see a great advance in two-seaters in European soaring circles. They are beginning to invade the field of records heretofore reserved for single-seaters. The only sailplane which crossed the Alps twice is a two-seater. The distance record for two-seaters has already been pushed to 252 miles. The absolute record for duration was set at 51 hours by a two-seater as compared with a 41-hour duration record for single-seater. Until recently aerodynamic and structural problems hampered the development of two-seaters but with the development of the modern wing, with mechanical improvements on control, and aerodynamical improvements on rudders, the two-seaters have been made almost the equivalent of the best single-seaters in performance.

Design trends in Europe may be summed up to include the use of thinner wing sections, lower wing loading, greater comfort and safety for pilot, and better instrumentation.

Sailplanes intended for high altitude work must be very strong and have greater stability than normal sailplanes. They must be fitted with electrically heated and electrically operated instruments, with oxygen equipment, and carry protection against control failure through freezing.

America's Answer

(Continued from page 29)

the monthly deliveries within the capacity of 1,000 men. This can then readily be extended to cover the average number of men who will be employed in the two years of the expansion program. By this method, we see that under full capacity conditions, more than the required 10,500 airplanes can be produced so that the airplane industry will only be at about seventy-nine per cent capacity. For the engine-propeller portion of the industry, the percentage of capacity will be ninety-one per cent. As mentioned before, these tolerances are desirable to allow for unforeseen contingencies. They are, nevertheless, gratifying as an indication that extensive floor space expansion is not required to do the job.

It is essential that every unit of the industry be kept to approximately the same percentage of its capacity so that overloading of isolated units will not result, inviting them to over-expansion. Sub-contracting within the industry would be a more desirable procedure in such contingency.

Having determined production capacity, it is now desirable to study appropriations from the standpoint of their adequacy for the present coupled with estimate of probable requirements for the next fiscal year. In Table 11, for the Army, Navy, export and transport markets, the average weight of plane (previously determined) is multiplied by the quantities required and the unit price to give a total cost. This process is repeated for engines and instruments, permitting determination of the grand total involved in each of these fields. The results, it should be remembered, cover the two year period involved in the expansion program.

To the layman, at least, there is always considerable confusion in trying to determine from appropriation summaries the exact funds available for the procurement of aircraft. These are generally hidden in many appropriation bills which frequently are so worded as to make it well-nigh impossible to determine just what proportion is for new construction, or what may be ear-marked for training, maintenance, or other uses. From such sources as are available, it appears that the situation as now being considered by Congress is about as shown in Table 12, where the funds are divided between "regular" appropriations and "special" funds appropriated for increase of the air forces. An indication of probable required appropriations for the fiscal year after the present one now being debated in Congress is worked out on the basis of funds needed (as determined in Table 11). From this determination, it would appear that for expansion of the Army air force, the full $300,000,000 originally mentioned for this purpose by the President should be made available for the exclusive procurement of aircraft. If $170,000,000 only is allowed for the purpose, as recently indicated may be the case, the appropriation in the second year of the program will naturally have to be considerably higher than would otherwise be necessary, or than should be necessary, for the "regular" appropriation bill for that year.

When making a comprehensive analysis of this type, it is desirable frequently to check up by other methods than that basically used, in order to be sure that conclusions are approximately correct when viewed from other angles. A check on funds required is made in Table 13 by studying labor output. First there appear figures showing the airplane and engine sales-dollar sub-division. Then, by determining the average yearly wage of the workmen and dividing by the percentage that direct labor bears to the sales value of the airplane or engine, a figure is determined which shows the dollar value of airplane and

(Turn to page 80)

Table 9 Production Capacity—Airplane

	Men	Structure Pounds	Deliveries per Month in Similar Quantities	Unit Cost Used for Quantity "Weighting"	Deliveries per Month in Anticipated Quantities
Actual Accomplishment	2 800	2 750	61 0	7 60	61 0
Army — Average	1 000	5 388	10 2	7 00	10 2
Navy — Average	1 000	4 430	13 0	8 35	11 4
Export — Average	1 000	4 750	12 8	7 00	12 8
Transport — Average	1 000	15 310	3 92	7 50	3 7
Average — Above Items	1 000	5 650	10 0	7 27	10 2
Private and Small Commercial	1 000	855	92 0	2 41	265 0

U. S. Airplane Industry—Military, Export and Transport

	Men	Structure Pounds	Square Ft. Floor Area	Sq. Feet per Man	Deliveries per Month
Present Personnel	33 000	5 650	6 081 000	184	335
One Full Shift	34 000	5 650	6 081 000	179	347
Average — 7/1/39 to 7/1/40	48 000	5 650	6 400 000	133	490
Average — 7/1/40 to 7/1/41 (Capacity)	60 700	5 650	6 700 000	110	550
					During 12 Months
Deliveries — 7/1/39 to 7/1/40					5 880
Deliveries — 7/1/40 to 7/1/41					7 440
Total Deliveries for 2 Years					13 320
Delivery Requirements for 2 Years (Incl. Spares "Equivalent")					10 500 or
Percent of Capacity					79%

Table 10 Production Capacity—Engines and Propellers

	Men	Weight (Lb.)	Deliveries per Month	Cost Incl. Quantity "Weighting"
Actual Accomplishment	3 000	1 260	270	7 5
Army — Average	1 000	1 384	57	7 5
Navy — Average	1 000	1 694	71	7 5
Export — Average	1 000	1 600	71	7 5
Transport — Average	1 000	4 125	28	7 5
Average — Above Items	1 000	1 878	60	7 5
Private and Small Commercial	1 000	300	710	3 00

U. S. Aircraft Engine and Propeller Industry—Military, Export and Transport

	Men	Weight (Lb.)	Square Ft. Floor Area	Sq. Feet per Man	Deliveries per Month
Present Personnel (* Greater Concentration than Example means more Sub-Contracting Elsewhere)	9 000	1 878	2 310 000	*256	540
Average — 7/1/39 to 7/1/40	10 300	1 878	2 450 000	238	618
Average — 7/1/40 to 7/1/41 (Capacity)	12 160		2 960 000	222	726
					During 12 Months
Deliveries — 7/1/39 to 7/1/40					7 420
Deliveries — 7/1/40 to 7/1/41					8 710
Total Deliveries for 2 Years					16 130
Delivery Requirements for 2 Years (incl. spare Engines and Engine spares)					14 670 or
Percent of Capacity					91%

(Continued from page 78)

engine that each workman produces in a year Extending this by the average number of workmen in the period under consideration, on a full capacity basis, and multiplying by the per cent capacity required, we arrive at a figure which can be directly checked against the values appearing in Table 11 As this check worked out within 3.7 per cent for the airplanes and 6 7 for the engines, it appears that reasonable reliance may be placed on the basic analysis.

In analyzing the sales-dollar, a uniform profit of ten per cent is used as representing the maximum likely to be realized or allowable under the profit-limitation clauses of present laws Variations in this figure will, of course, affect the percentage of labor slightly although not enough to substantially change the results One point worth mentioning here is the relationship between overhead personnel in the industry when compared to direct labor For the airplane branch of the industry, the ratio is approximately thirty per cent; in the engine branch sixty per cent, and in the propeller division one hundred per cent, with a weighted average of thirty-six per cent for the whole industry The variation between different branches of the industry reflects to some extent the differing amount of sub-contracting resorted to by them, airplane manufacturers using less than engine and propeller producers

Having discussed the immediate problem from the standpoint of appropriations, fund requirements, and capacities, it now appears desirable to determine the average airplane cost. This is done in Table 14 where consideration is given to the airplane itself, sub divided between structure, engine and instruments, first without reference to spares and second, with spares The details involved in deriving the amounts shown in Table 14 are taken from Table 11, the weight being multiplied by the unit price. Such average cost is shown for the "average" plane of the Army, Navy, export and transport fields and, as well, for the average of the four which works out at $62,000 each without spares, and $77,400 each including the spares.

These amounts will be useful in making rough calculations as to funds required for any later expansion program or change in the present one To many, it is likely that these unit prices will appear high A word should therefore be given as to the causes which have brought about increases in airplane costs during the past ten years. In Table 13, the factors involved are enumerated, resulting in the estimate that in the five years after 1929, airplane costs increased sixty-five per cent, and in the past ten years, one hundred and thirty per cent

Our major consideration has been given to that portion of the industry which is engaged in the manufacture of military aircraft, whether for our own government or for export, and large transport planes Some word on the industry involved in producing planes for the private owner and for the small commercial user should also be given, so as to round out the general picture. Similar computations have been made to determine the average weight of the private-owner airplane together with its cost in the quantities now being manufactured and the capacity of the industry engaged in its manufacture. Without going into details, it can be stated that this investigation has shown that this branch of the industry can more than double present output without reaching its capacity The net result of this conclusion is that the two problems can be considered separately as they do not involve each other There might, perhaps, be some possibility of sub-contracting to the private owner branch of the industry, if necessary, although the production increase resulting will be relatively small

Although the floor capacity of the industry has been shown to be sufficient with but ten per cent increase for better balance, the problem is not fully solved without studying the probability of expanding labor sufficiently rapidly to complete the program by the desired date. Experience to date, augmented by recent governmental attention to this problem, indicates it can be done. There are several factors which, however, will tend to cause delay in getting started One is slowness on the part of Congress. Although the President's request for air force expansion was made in January of this year, it was not until May that first authorizations were approved and contracts under this program placed. Additional appropriations will undoubtedly be available by July 1st so that further orders can be allotted by August 1st (as assumed in this article) But even after prototypes are tested, production specifications written, and contracts placed, there are many things that must be done before planes can be delivered. Shop drawings must be finished, releases made to feeder shops produced and then, finally, assembly of the airplanes completed

In general, it is estimated that in the case of types which have been previously produced in quantities of more than one, a factory can start steady deliveries at the rate of say twenty-five per month, six months after date of contract In other words, deliveries will really not be under way until January 1st, 1940 for contracts now being placed. Checking the

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Table 11

Table of Funds Required (2 Years)

Item	Army Quantity	Navy Quantity	Export Quantity	Transport Quantity	Total
Airplanes	5 200	1 800	2 000	300	
Spares	520	500	300	20	
Total Units	5 720	2,100	2,300	320	
Weight	5 488#	4 430	4 730	15 310	
Unit Price	$7 00/#	$8 35/#	$7 00/#	$7 50/#	
Total Cost	$228 000 000	$80 000 000	$76 000 000	$36 800 000	$420 300 000
Engines & Propellers	5 200	1 800	2 000	300	
Spares	2 588	1 035	575	172	
Total Units	8 788	2 835	2 575	472	
Weight	1 984#	1 584	1 900	4 112	
Unit Price	$7 50/#	$7 50/#	$7 50/#	$7 50/#	
Total Cost	$131 000 000	$24 000 000	$30 000 000	$14 600 000	$210 900 000
Instruments & Equipment	5 720	2 150	2 300	320	
Weight	428	580	350	726	
Unit Price	$18 50/#	$18 50/#	$18 50/#	$18 50/#	
Total Cost	$40 300 000	$15 200 000	$14 300 000	$4 300 000	$79 700 000
Total Costs	$412 300 000	$129 200 000	$122 800 000	$55 700 000	$719 500 300

Table 12

Indicated Appropriations for the Procurement of Complete Airplanes

	Army	Navy
Regular Appropriation Bill	$20 341 000 00	$41 000 000 00
Special Appropriation for Increase in Force	170 000 000 00	21 000 000 00
Totals	$190 341 000 00	$62 000 000 00
Funds Required to Meet Present Program Over 2 Year Period. (From Figure 11)	$419 500 000 00	$129 000 000 00
* Appropriation Required Next Year	228 959 000 00	*267 000 000 00
If Total of $300 000 000 00 (instead of indicated $170 000,000 00) had been available for purchases of Aircraft the additional amount would equal	130 000 000 00	
and the Appropriation Required Next Year would be	*591 959 000 00	

(* Which is about what would be anticipated for the larger Air Force.)

The Birdmen's Perch

THINGS-TO-REMEMBER DEPT.

1 To shoot your brother-in-law
2 The date of your wedding anniversary
3 To write Whopper about Gulf Aviation Gas

You can cut the list down to two right away (to one, if your b l l and a gun are handy) by authoring that tall tale today. Remember the monthly champ liar gets a swell diploma. Mail yours to

MAJOR AL WILLIAMS, alias "Tattered Wing Tips"
Mgr Gulf Aviation Products Gulf Bldg Pittsburgh, Pa

SPECIAL CITATION

On March 29th the National Safety Council bestowed Certificates of Award upon eight domestic airlines for their outstanding safety achievements

American Airlines, Inc
Eastern Air Lines Inc
Pennsylvania-Central Airlines Corp
Braniff Airways, Inc
Continental Air Lines, Inc.
Inland Air Lines, Inc
T W A (Eastern Division)
United Air Lines

Our congratulations to all for a fine record And we're especially proud that the first three mentioned are Gulf clients—Eastern and Pennsylvania-Central being regular users of Gulf Aviation Gas and Gulf Airline Oil, while American buys gasoline from us in certain territories

ADVICE TO THE LOVELORN DEPT

Dear Auntie Wing-Tips

My boy friend swears horribly because the bearings in his airplane motor keep burning out What *shall* I do?

("*Wondering*")

"WONDERING

Be tactful Secretly fill his pockets with Gulfpride, the only oil refined both by conventional methods and by Gulf's exclusive Alchlor process He'll be amazed, my dear, when you tell him this patented *extra* process removes *more* sludge and carbon formers from the 100% Pure Pennsylvania

Auntie (Versatility) Wing Tips

P S If, after you (and handy Gulfpride) have removed all excuse for his vulgarities, he still swears, try putting cotton in your ears

P S jr As a last resort, get a new boy friend

SCRAMBLED SPELLING

This month we have a different type of problem contributed by Bob Newill of Dayton, Ohio Many thanks, Bob, and we hope our readers don't take as long to unscramble the following plane names as we did

1 RAINWER 2 SEWRBERT 3 CHELEOKD 4 YESKVERS 5 BECTFEARHC 6 SLOCNODADEIT 7 YRRTOCALFTA 8 COMOPNOUE 9 RATSNAP 10 TNOSNIS

We've got the list of answers handy so send in yours to Prof Wing Tips to be checked

THIS MONTH'S WHOPPER

Dear Major

Quite a few years ago while barnstorming, I gave an exhibition at a place called Texaloosie After the show a couple of brothers wanted me to test-hop something they called a Flying Flea powered with a 1½ h p Whirlo washing machine motor

I had a little trouble getting it off so they called in a friend who had a secret preparation, claimed he had put a couple of drops on an old alarm clock and it gave him enough power to run a 16-inch centrifugal irrigation pump This fellow came over with a ketchup-bottle full and that was all he'd been able to get from the Gulf Oil Co

About dusk I put a few drops of his stuff in the tank of the Flying Flea There was a terrific whoosh! We stood around stunned, then everybody looked straight up and there in the sky was the prettiest single set of fireworks anybody could hope to see The Flying Flea had skyrocketed up and with a *poom* exploded into about 1000 smaller Flying Fleas which skyrocketed up and exploded into still smaller Flying Fleas until the whole sky was aglow with midget Flying Fleas Pretty soon the whole spectacle faded away toward the west

Several years later while visiting friends in San Francisco, I felt something zoom up my back Listening intently, it seemed I recognized the drone of the little Whirlo Mine host suggested I jump into a bath tub and shake, which I did Sure enough there was one of the little Flying Fleas banking around the tub like six entrants in an international speed race

"That's a flea," he said

"You're telling me? I filled the tub up with water

"California is full of fleas," he contributed

"But this one is different," I said "this is a Flying Flea" And to prove my point I let the water set for an hour, bottled it up and sold it as cleaning fluid

Now if that stuff I put in the original Flying Flea is what is now know as Gulf Aviation Gas boy, Major, YOU *GOT* SOMETHING! *Yours,*

Tom P Mathews

(*Continued from page 80*)
problem from another angle, experience has shown that an airplane company will expend sixty per cent of its costs on a contract at the time the first plane is delivered when the total quantity under order is fifty planes. This percentage changes to forty when the quantity is one hundred, to thirty-three when the quantity is one hundred and fifty, and to twenty-five when the quantity is three hundred. These percentages are indicative of the time lag between receiving a contract and reaching substantial and fairly constant monthly deliveries.

The foregoing applies to what may be termed "current" models. If, however, planes are ordered from blueprints or from one prototype, as in our eagerness to equip our squadrons with the most up-to-date types may be the case to some degree in our expansion period, then it may be anticipated that on the average, twelve months will elapse before steady production deliveries are realized. The increased time is to care for preparation of production drawings. Naturally, this figure varies, depending upon the size of the airplane involved but will always lie between ten and fourteen months. Let us assume for this case that twelve months after a contract is placed, deliveries will reach twenty-five airplanes per month. Now, if the order is for three hundred planes of an entirely new type, it will be twenty-four months before the last ship is delivered, i.e., twelve months allowed for attaining uniform delivery plus twelve months to complete the contract, at delivery rate of twenty-five planes per month.

Although in many cases, orders will exceed three hundred, reaching five or six hundred for certain classes, it should be realized that in general, the average for all classes, that is, Army, Navy, export and transport, will be about two hundred and twenty airplanes. This can be readily checked as follows: There are about fifteen classes of Army planes, ten classes of Navy planes, and five of transports, with duplicates in some classes, making approximately forty-two distinct types being produced at one time. When the total of 9,300 airplanes required in two years is divided by forty-two, the answer is approximately two hundred and twenty for the average quantity in each order. All of this means that more than any other factor, getting under way and getting contracts actually placed at an early date is the most important single factor involved in obtaining the full strength of air forces which we have set out to realize by the required date, July 1, 1941.

It is interesting to note, relatively, the yearly production rates of the past, of the present, and of the future and those which currently maintain for certain foreign countries. A final tabulation, Table 16, shows this information. Amounts for dollar value for various periods of time are indicated with men in the industry, average unit price of airplane, and number produced per year. Roughly speaking, in terms of dollar value, it is seen that if 1938 production is taken at 100, then the average production of the four years previous to that was 50, whereas for the next two years it will be 282, levelling down to 189 thereafter. While we must produce in the next two years an average of 4,650 airplanes per year, it is estimated that England is now producing at the rate of 7,500 planes per year and Germany 12,000.

What then does it all mean? First, the industry can definitely do the job with only a very small additional "balancing" expansion of about ten per cent in floor space.

This being the case, it is extremely important that we guard against over-expansion. Now is the time to consider applying the brakes. World-wide demand for military aircraft is at a high level and must inevitably fall off at some time in the future. Let us not forget the parallel of 1929. A quotation from a speech given by President Roosevelt in Buenos Aires three years ago is relevant. At that time he said: "* * * re-armament employment is false employment; it builds no consumer goods for a lasting prosperity. The nations face the day when their weapons of destruction must be used against their neighbors or when an unsound economy, like a house of cards, will fall * * *".

It is far better to meet expansion needs with double shifts and thereby to reach an absolute floor space capacity than so to expand floor space as to require but one shift during the air force expansion period and then have a semi-idle industry thereafter! To maintain our new air force after 1941, a complete one-shift industry is necessary on the basis of present estimates.

Let us not expand any further than that suggested, at least until there is a commercial need definitely in sight, as might well maintain should the very sound policy now receiving some attention, of eliminating surcharge from all air mail, becomes law in the meantime. This policy, incidentally, is now in effect in Holland and Great Britain. An over-expanded industry would result not only in idle plant facilities but also in a vested interested pushing for continuing military expansion.

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Table 13—The Airplane and Engine "Sales Dollar"

	Planes				Engines	
	Quantity				All	
	100	220	300	1,000		
Labor	30%	28.5%	26%	24%	18.00%	
Overhead	21%	18.6%	15%	15%	45.00%	
Manufacturing						21.00%
Sales & Administrative						09.00%
Service						09.00%
Taxes						06.00%
Engineering	5%	4.5%	4%	3%	10.00%	
Material	27%	29.5%	35%	35%	25.00%	
Finished						15.00%
Raw						09.00%
Tools	7%	5.5%	10%	12%		
Profit	10%	13.0%	10%	10%	16.00%	
Total	100%	100.0%	100%	100%	100.00%	

Labor Checks

Airplanes: 40 Hrs. Week x $.70 per hour x 52 weeks = $1,456 per year;
$1,456 ÷ 28% of labor = $5,200 worth of airplane/man/year.
$5,200 x 54,350 men (average 2 yrs.) x 79% (% capacity required) = $223,000,000.00
Checks Against $428,300,000 (FIGURE 11) ÷ 2 = $214,650,000.00 (3.7% less)

Engines: 40 Hrs. Week x $.80 per hour x 52 weeks = $1,665 per year
$1,665 ÷ 15% of labor = $11,100 of engine-propeller/man/year
$11,100 x 11,200 men x 81% (% of capacity required) = $113,000,000.00
Checks against $210,600,000.00 (FIGURE 11) ÷ 2 = $105,280,000.00 (6.7% less)

Table 14—Average Plane Cost
(With and Without Spares)

	Army	Navy	Export	Transport
Airplanes	$41,280	$37,000	$33,380	$115,000
Engines & Propellers	14,880	11,975	12,000	30,000
Instruments & Equipment	7,920	7,035	6,480	13,400
Total Unit Price	$64,080	$56,000	$51,780	$159,300
Average Unit Price of All without Spares equals				$62,500
Cost Including Spares (from Figure 11)	$415,300,000	$120,200,000	$122,300,000	$55,700,000
Cost of Planes Alone (number planes)	$332,600,000 (5,200)	$101,000,000 (1,800)	$103,600,000 (2,000)	$47,800,000 (300)
Cost of Spares	$79,200,000	$28,200,000	$18,700,000	$7,900,000
Average % Spares—(of Planes)	23.8	27.5	18.1	16.5
Average Cost of Plane—Including Spares	$79,300	$71,000	$61,100	$186,700
Average Unit Price of All with Spares equals				$77,400

(*Continued from page 82*)

which would appear a dangerous and undesirable state of affairs, both from the standpoint of national economy and international order

I believe that we can consider the present program involving an Army air force of six thousand planes and a Naval air force of three thousand as fundamentally sound Considerations of rapid obsolescence definitely limit the size of standing air force which can efficiently maintain Twenty-four months for production deliveries after a prototype has been developed is a long time in this rapidly advancing art!

We have certainly not reached the stage of standardized design and we assuredly do not need to maintain an air force which, in size, equals those of European nations We do want and by our present program will have a sufficiently large air force to meet any threat to our interests, to provide facilities for training pilots, and for preparing the industry.

A more fruitful safeguard for the future is a present emphasis on research facilities Research, implying quality, remains the foundation of an efficient air force.

Our original assumptions definitely eliminated from analysis, considerations of extensive expansion which might be caused by a national emergency or major war. How to meet emergency expansion really forms the subject for another article, but a word or two here on the matter appears in order. In the first place, the present industry geared to two shifts cannot be called unprepared, even though emergency conditions would call for far greater capacity. To meet that need, one possibility would be an increase in sub-contracting. This cannot be efficiently extended very much as regards the airplane although for the engine and propeller branches of the industry, substantially greater possibilities of sub-contracting are present These, undoubtedly, could be efficiently carried out in the automotive industry, perhaps on the basis of initial tools manufactured by the aircraft engine and propeller companies In any event, engineering control by the aviation industry, plus management advice is essential

Much could be written on the "shadow" industry as worked out in England. Certainly, government financing for assembly plants is sound, these to be used for emergency only Here again, the experience of England has definitely demonstrated the advisability of maintenance of engineering control by the company developing a given airplane or engine design

A third type of expansion and one containing many desirable features might be the financing of extensions to existing plants of the industry with government funds, the supplementary facilities to be rented by the factory involved from the government, title remaining with the government after the emergency had passed. One thing of which we are certain is that expansion should not be means of government-owned and operated aircraft manufacturing plants. Experience here and in many countries abroad completely bears out this contention Such plan is, perhaps, most definitely condemned by study of the situation which maintained in France during the two or three years of the nationalization period There were several months during this period when one company in this country delivered as many planes as were delivered by all companies in France which employed a personnel ten times as great! Aside from the probable failure of such factories in time of emergency, there would also be the matter of destructive peacetime government competition.

There is the possibility of reducing the number of designs and designing companies, setting up a group of production companies a number of whom could construct designs in production emanating from one development firm. This plan is, to a certain extent, followed in Germany and, from an efficiency standpoint, has much to commend it. Here again, however, need for engineering follow up and control by the original designing firm is essential. For our country the scheme does not appear desirable.

Possessing, as we do, adequate plans for air force expansion and facilities for carrying them out, let us now buckle down to the job of carrying them through to completion within the time limit set Let us stick to the plan and see it through without digressing too much. Let us also extend our research facilities, thus establishing a sound foundation for an efficient air force

Such planned action, carried to conclusion, will do much to convince other countries of our ability, quickly and efficiently to take care of further emergency expansion should such unfortunate contingency be forced upon us

Table 15—Causes of Increase in Price of Airplanes

	1929	1934	1938
1—Number of Years	0	+5	+10
2—Size (including Horsepower)		30% Increase	105% Increase
3—All Metal Construction	—	20	50
4—Introduction of 4-Engine Ships	—	3	15
5—Increase in Proportion of Bombardment vs. Pursuit—1:2 vs. 1:4	—	15	30
6—Increase in Instruments and Equipment	—	5	10
7—Total Increase over 1929		+58	+210
(Quantity Change)	(38)	(50)	(300)
(Production Factor)	(4)	(345)	(223)
8—Price Reduction account of Quantity Increase	—	—15% Decrease	—80% Decrease
Final Price Increase (Item 7 minus Item 8)		65%	130%
Pursuit Ship Check (excluding Items 4 and 5):			
Airplane	$10 000	$15 500	$22 000
Engine	4 000	7 000	12 000
Instruments	3 000	4 500	1 800
Totals	$17 000	$27 000	$35 800
Relation	—	59%	128%

Table 16—Comparison with Other Years and Other Countries

	Dollar Value	Ratio (1938 = 100)	Men in Industry [a] (Direct Labor)	Average Unit Price (Including Spares)	Number Produced per Year
1933 thru 1937 (average per year for 5 years)	$62 750 000	50	25 000	$60 000	1 060
1938	127 000 000	150	37 000	$65 000	1 950
July 1, 1939 thru July 1, 1941 (average per year in a 2 years)	323 750 000	282	52 000 (1st yr —46 000) (2nd yr —58 000)	$77 000	4 650
After July 1, 1941	341 000 000	189	50 000	$85 000	3 010 [b]
England (currently) [c]			100 000		Rate of 7 000 per year
Germany (currently) [c]			150 000		Rate of 12,000 per year

Notes

(a) Note that Total Personnel equals about 35% more than Direct Labor

(b) Army 6000 (present authorized strength) x 22.3% (Figure 3) =1,340
Navy 3000 (present authorized strength) x 22.3% (Figure 3) = 670
Export (Note Foreign "dumping" and intensified competition = 600
Transport (not allowing for increase resulting from elimination of air mail surcharge) = 400
Total 3 010

(c) From study of five estimates appearing in recent articles.

Stacks and Rings

(*Continued from page 33*)

from in front of the engine baffle and directed at the bottom opening of the shroud. This scoop will feed air under pressure into the shroud. An aluminum tube of $1\frac{1}{2}$ to 2 inches in diameter makes a satisfactory scoop for this purpose. This scoop should not fit the bottom of the shroud closely because if it is clogged by ice or snow no hot air will be available to the carburetor. One of the big advantages of shroud preheating lies in the fact that hot, dry air can be drawn from the rear of the engine irrespective of the weather conditions.

Fig. 2 shows the exhaust collector for a 400 horsepower Pratt & Whitney Wasp Jr. engine. This installation is in a nacelle of a twin-engine amphibian. The collector is a shroud type but since the carburetor is at the bottom of the engine the fresh air is taken in at the top and drawn downward into the carburetor.

Intensifier Tube Exhaust Collector

The exhaust collectors shown in Figs. 3 and 14 are typical intensifier tube type collectors. Air that enters the scoop at the bottom center is carried upward through two intensifier tubes to the carburetor. Spillways are provided on the carburetor air scoop to permit spilling the heated air into the atmosphere when not needed. The intensifier tubes run up through the center of the exhaust collector ring and are surrounded on all sides by hot exhaust gases. To increase heat transfer, intensifier tubes are frequently indented or dimpled thus increasing the surface area. This type of distortion also creates turbulence within the intensifier tube so that more air comes in contact with the hot surface.

It should be noted in Fig. 3 that the intensifier scoop does not extend even as far forward as the exhaust ports so it must open behind the cylinder baffles. This location is chosen purposely to prevent snow or ice packing up in the scoop and sealing it. Behind the baffles dry, warm air is picked up at all times. Some ram is also available in this location.

Hot Spot Type Exhaust Collector

The collectors shown in Figs. 9 and 15 are hot spot types such as were commonly used a few years ago. It will be noted that an exhaust tube is led aft from the main collector ring through a shroud in the engine accessory compartment. This exhaust tube attaches to one end of a hot spot heater through which the fuel-air mixture passes before entering the engine. The exhaust gases warm the mixture and improve its distribution as it passes through the hot spot. From the far side of the hot spot an exhaust tube carries the exhaust gases back into the opposite collector ring from where they are discharged.

The shroud in the accessory compartment is joined to the carburetor cold air intake system through a valve controlled by the pilot. Due to the short length of shroud and the small exhaust tube the hot air obtainable is only from 20° F. to 30° F. above the outside air temperature. This is not sufficient for high power engines of the present day.

Cabin Heating

There are a number of methods of heating the cabins of airplanes. The most common method is shown in Fig. 14. This works on the same principle as the intensifier tube excepting the air is carried through the tail pipe of the exhaust collector only. The air from this heated tube is carried to the cabin where a valve controls the amount released. In the usual installation a seamless Inconel tube is used to carry the air through the exhaust tail pipe. Inconel is chosen because of its strength qualities at elevated temperatures. A small steam boiler heated by the exhaust tail pipe will also furnish satisfactory cabin heat.

Turbo Supercharger, Exhaust Driven

A turbo supercharger is driven by means of a turbine wheel actuated by the exhaust gases. The exhaust gases are led from the engine by a waste gate (a valve controlled exit permitting spillage of the exhaust gases when supercharging is not desired) and terminate in a nozzle directed at the turbine wheel. Since the supercharger is supported independently of the engine a tight, flexible connection must be made between the exhaust pipe and supercharger. A sylphon type flexible connection made of Monel metal, 18-8 corrosion resistant steel, or Inconel has been used successfully for this purpose. Another type of spring-loaded flexible joint that has been used in the past for this purpose is shown in Fig. 16.

Measurements

To check the efficiency of each new design of exhaust collector it is advisable to make check measurements of the back pressure at each cylinder. It is also advisable to check the carbon monoxide concentration in the cockpit of the airplane to verify the locations of the exhaust outlets and the general tightness of the exhaust system. The temperature adjacent to the exhaust collector must also be checked to prove there is adequate ventilation and cooling to prevent burning of the cowl or interference with proper functioning of the engine.

Back Pressure Measurements

The back pressure is measured in each exhaust elbow as close to the cylinder exhaust port as possible. To insure the measurement of static pressure only, the attachment fitting for the pressure recording line should be located on a straight portion of the exhaust elbow. If this fitting is located on a curve dynamic suction or pressure will affect the accuracy of the measurement. If possible the fitting should be located on the same radius from the center of the engine as the exhaust port center. With the fitting in this location it is believed an average value of the back pressure will be obtained.

The attachment fittings to accommodate 3/16-inch pressure recording lines should be welded or brazed to the exhaust elbow. A female fitting should be used that can readily be plugged after completion of the measurement tests. Only a small No. 50 or 60 drill hole should be drilled in the elbow wall under the fitting. This size hole will reduce pulsation in the pressure recording line and permit easier reading of the gauge. All burrs around the drilled hole must be removed to avoid turbulence.

The pressure line from each elbow must be led to the pilot's or observer's station. At this point a pressure gauge calibrated in inches of water should be mounted. An airspeed indicator is satisfactory for this purpose when recalibrated in inches of water. If an airspeed indicator is used for this purpose its static outlet should be tapped into the regular airspeed static line. The pressure lines from the exhaust elbows should be connected to the dynamic outlet of the calibrated airspeed gauge. Since the pressure at each cylinder must be

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Stacks and Rings

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read individually it is necessary to have a common panel with one more connection than the number of cylinders being tested. This extra outlet is connected to the gauge. By means of a short rubber tube jumper this gauge outlet can be joined to each of the other connections in turn and a reading taken. An excellent panel has been developed for this purpose.

It is customary to check the back pressure in full throttle flight at 2000 feet altitude and also, if a supercharged engine is installed, at the critical altitude of the engine.

Carbon Monoxide Determination

The instrument commonly used for measuring the carbon monoxide content in the cockpit or cabin air is manufactured by the Mine Safety Appliance Company. The operation of this instrument involves passing a steady flow of the air under test through a hopcalite cell. The hopcalite acts as a catalyst in converting the carbon monoxide in the test sample into carbon dioxide. This conversion generates a quantity of heat which is directly proportional to the amount of carbon monoxide present in the sample. This heat is measured by a series of thermocouples which are connected to a milli-voltmeter. This is the indicating meter. It is calibrated to read directly in hundredths of one percent. One instrument is available that is calibrated to read from 0 to .01% on one scale and from 0 to 1% on another scale. The first scale is more applicable to aircraft use since the permissible content varies from .005% to .01% for different airplanes. .01% carbon monoxide content is the maximum permissible concentration if mild poisoning and headaches are to be avoided.

The standard carbon monoxide indicator is operated by self-contained dry cell batteries so its installation consists of mounting it in the airplane in a location visible to the observer. Another model is designed to tap into the vacuum pump line to obtain a steady flow of the sample air. The indicator should be rubber mounted to protect the sensitive milli-voltmeter from shocks. A 5 foot metallic sampling line may be held at any place around the cockpit or cabin, or in the vicinity of skin openings to obtain a test sample. A small motor operated pump in the indicator will suck the test sample through the tube and into the hopcalite cell.

Before running check tests the carbon monoxide indicator must be run for 10 minutes with the sampling tube end in pure air. This is done on the ground before the engine is started when battery operation is used and insures a thorough cleaning out of the indicator. The milli-voltmeter is then adjusted to zero and the test begun. With full rich mixture the airplane is flown between 1000 and 5000 feet altitude at full throttle, and at cruising power. The sampling line is held at various points around the cockpit for a minimum of 2 minutes and a reading taken. After each reading is taken it is advisable to extend the sampling tube out of the airplane for a short time to clear out the indicator.

Temperature Measurements

In the shroud type of carburetor air preheater the aluminum cowling is one to two inches away from the exhaust collector. If the shroud was not ventilated the temperature would soon increase to a point where the cowl would burn. When aluminum shrouds are used the temperature within the shroud must not exceed 480° F. If corrosion and heat resisting steel sheet, or Inconel sheet is used for the shroud the permissible temperature may be increased to 570° F. The temperature in the shroud can be readily measured with the ordinary type thermocouple.

Recommendations

The present trend in aircraft engine development is to increase the power by adding a second bank of cylinders thus keeping the diameter and frontal area the same. Increasing the present power output by 50% to 100% will require up to a 50% increase in the diameter of the exhaust collector tubing. Locating these larger tubes within the available space will be very difficult and there is bound to be interference with other units of the engine. The enormous quantity of heat thrown off by the exhaust collector will be one of the main causes of trouble. The following methods are recommended to protect the important parts of the engine installation from this excessive heat.

1. Intake Manifolds. The exhaust elbows and collectors of high power engines are in close proximity to the intake manifolds. There is a loss of 1% in power for about every 7° F increase in the temperature of the mixture in the intake manifold. This loss in power is not registered on any instrument in a modern airplane but is nevertheless a loss of power that affects performance and should be eliminated. Wrapping the intake manifolds with asbestos is one method of protecting them from the exhaust heat. Another suggested method is the use of a highly polished aluminum or 18-8 corrosion resisting steel shield mounted on the intake manifold and directed to repel the exhaust heat.

2. Fuel System. At 20,000 feet altitude gasoline will boil at 100° F. It is difficult to keep an engine accessory compartment below this temperature with a huge exhaust collector mounted just forward. It will be particularly important to keep the fuel cool in a stratosphere plane flying at 30,000-35,000 feet with supercharged high power engines. The development of a fuel cooler or radiator is one solution. Another method with which the author has had some success consists of a 1½ inch flexible tube that leads from in front of the engine baffle back to the fuel strainer. By this means a cooling jet of air is directed on the largest reservoir of fuel in the engine accessory compartment. The colder air blast obtainable at altitude compensates for the lower boiling point of gasoline due to reduction of pressure with altitude. Irrespective of the cooling method used it is advisable to run the fuel lines as direct as possible in the accessory compartment to minimize their absorption of heat.

There is a strong possibility that engines will be housed within the wings, or successful pusher type airplanes will be developed within the next few years. In these airplanes it will be practical to discharge the exhaust gases through slots in the trailing edge of the wing. By so doing a propulsive force will be obtained. In addition it is believed the flow over the entire wing will be improved. These two effects will appreciably increase the overall efficiency.

On all new airplanes it is recommended that the exhaust outlet be directed aft and belled slightly so the passing air will create a suction. By this means the back pressure within the collector can be reduced with a consequent gain in power.

Another improvement in performance is realizable by installing vanes in the exhaust outlet to smooth the flow of the exhaust gases. This is particularly true when the exhaust outlet is near a wing.

[This is the last of three articles. Parts I and II appeared in AVIATION *for April and May, 1939]*

LEWIS HOLY NAME SCHOOL OF AERONAUTICS..

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The basic course is aeronautical engineering, for which an excess of 4500 class hours is required for the four years. This is approximately 700 hours more than an ordinary four year engineering college course. A flight course of 300 hours is optional and includes advanced blind flight and airline procedure as a part, in modern flying equipment ranging from 50 to 330 h. p. Students must take the aeronautical engineering course to be eligible for flight training. Aeronautical Instruction leads to a Bachelor of Science degree in Aeronautical Engineering. *Flight* students receive commercial licenses from the Civil Aeronautical Authority and *all* students receive airplane and engine mechanics licenses during their instruction period. When you graduate from Lewis Holy Name School of Aeronautics you are fully equipped to enter the Aviation field and measure up to the qualifications demanded by the choicest positions. Our well equipped machine and airplane rebuilding shops give students a thorough practical training which is an absolute essential in a complete aeronautical education. The column to the right will give you more pertinent facts.

FACTS ABOUT THE SCHOOL

★ **ORGANIZATION—**
The School is under the personal direction of The Most Reverend Bishop Bernard J. Sheil D.D., V.G., the founder of the nation-wide Catholic Youth Organization. The school is strictly nonsectarian but under the direct supervision and control of the Catholic Archdiocese of Chicago; however religious facilities are provided for all denominations for those students who wish to attend.

★ **LOCATION—**
The school is located in Lockport Township 35 miles southwest of Chicago's loop and 6 miles north of Joliet on Route 66 (U. S.).

★ **TRANSPORTATION—**
All types of transportation are readily available. The normal form is the bus which includes on its scheduled run a stop in front of the school.

★ **ACCOMMODATIONS—**
(living) The school provides large double rooms to which two students are assigned. The school operates its own kitchen, bakery and laundry.

★ **FACILITIES—**
(land) The school is situated on 680 acres of land 180 acres of which make up the airport, the remainder is given over to recreational facilities and campus proper.

★ **REGISTRATION—**
Students who qualify will be accepted in June and September.

★ **COURSE—**
The basic course offered is Aeronautical Engineering and leads to a Bachelor of Science degree in Aeronautical Engineering at the completion of four years. The course requires in excess of 4500 class hours which is approximately 700 hours in excess of the ordinary four-year college course.

★ **FLYING—**
Each student enrolled in the Aeronautical Engineering course will receive twenty hours of flying. A flying course of 300 hours is offered as an additional elective.

★ **ATHLETICS and RECREATION—**
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REQUIREMENTS FOR ADMISSION—
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Fig. 923— "Hallowell" Steel Work-Bench with laminated plank in front. For Die Sinkers Tool Makers, etc.

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(Top illustration, twin-engine analyzer. Small illustration, instrument dial, single engine unit)

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For additional planes offered in other ads per make. Ads appearing in group form are keyed to indicate: F—Fore, T—Trade, W—Wanted

Aristocrat

Warner ARISTOCRAT — completely rebuilt —New fabric — upholstery — instruments— tires—Motor majored—steel prop. Must sell $700.00. Dupont Airport, Wilmington Dela.

Eaglerock

OX 5 Canter section EAGLEROCK Model A-2. Just rebuilt and relicensed. Engine time since overhaul two hours. $395.00. Donald C. Nichols, Jr. 2307 Pleasant Plain Avenue, Elkhart, Indiana

Eastman

EASTMAN AMPHIBION motor majored $1250.00. E4 Warners $225.00 each. A Camba. 1151 Lessups St. New Orleans La.

Fairchild

FAIRCHILD Biplane, 120 Ranger, licensed to Dec 1st, 1939. Eight hours on motor since factory overhaul. Bargain at $2,000.00 50% down, balance financed to reasonable party. Also Fairchild KR 21, licensed to July 1st, 1939. $300.00, 50% down. Aircraft Finance Co. 522 Hind Bldg., Buffalo N.Y.

For sale a FAIRCHILD 72 airplane newly covered and refinished especially for photographic mapping. This airplane has been ... and will be furnished with either an ... Wasp or an ... with controllable pitch propeller. Either motor has had no time since major overhaul. Wallace Aerial Surveys, 163 S Howard St., Spokane, Washington

Ford

WASP FORD licensed until December, 1939. We will trade this Ford the best available at any price. Wing time 1600 h. Cap. Never barnstormed. Becher Aircraft Sales Company. Pak Bettis Airport, R.D. Homestead, Pa.

Kellett

KELLETT Autogyro, 210 Continental. Motor relicensed in May 1939. 21 Flying hours since top overhaul. Continental is due for further information. Herman Schramm, 2 Broadway, New York City.

Luscombe

Luscombe "50" demonstrator. All extras—Perfect condition. Also new Luscombe 65's. Available immediately. Cruises at 105 M.P.H. Now exhibiting at Rockefeller Center, Museum of Science and Industry or Every Flying Service—Hangar 3/4, Floyd Bennett Field, N.Y.

INDEX

AVIATION "Classified" — June, 1939

Undisplayed ads offering only ONE make of plane are grouped under that make. Others appear under USED PLANES—General, and are numbered and indexed to enable readers to conveniently locate the make of planes offered. All other undisplayed and displayed ads—excepting those of employment and business opportunities—are numbered or referred to by number, and indexed for the reader's convenience in quickly finding ads

Porterfield

1938 DeLuxe PORTERFIELD, Warner 90 H.P. Total time 250 hours. Never cracked. Dual. Navigation lights and battery. Price $1,750. No trades. Original owner Carl Vogler, 2310 Salem Avenue, Cincinnati, Ohio.

Savoia-Marchetti

SAVOIA-MARCHETTI 3 place Amphibian 125 Kinner. Completely rebuilt with factory parts. Must be seen to be appreciated. Charles Fahrenkopf, 7252 80th St, Glendale, L.I., N.Y.

Stinson

STINSON 1937 SR5 Wright Hamilton controllable prop. Full set of instruments, radio receiver, special paint job, sound proof cabin with special upholstering. 105 gallon gas tank. Landing lights and electric flares. Ship privately owned and in beautiful condition. 330 hours on ship and motor since new. Motor just majored. Lew Wallace, 1801 Manassa Blvd, Denver, Colorado

Taylor (Cub)

TAYLOR CUB A-40-5 Continental, like new. Scarlet cream paint job. Wheel pants, strut cuffs, shock cord streamlined, leather upholstery. $950. Speed's Flying Service, Inc. Hillside Airport, Jackson Heights, L.I., N.Y.

E-2 CUB Perfect; total time 450 hours, 180 hours since major. Automobile accepted in trade. Michael Ott, Hadley Airport, New Brunswick, New Jersey (T)

Taylorcraft

TAYLORCRAFT, Franklin 50. Cream, red trim. Brakes, tail wheel, navigation lights. $1495. T. W. Zale, 375 W 15th Place, Chicago Heights, Ill.

1938 TAYLORCRAFT 40 with brakes. Oriental Lights, tailwheel and special door. Job 100 hours privately owned, never cracked. Asking $1,325. Northern Aeromarine, Traverse City, Michigan

Travelair

TRAVELAIR J6-9 modernized D, eight hours since motor major overhaul. Plane recovered a year ago. Completely equipped for aerial mapping and blind flying. Has two-way radio, Directional Gyro, Sensitive Altimeter, etc. Price with instruments $2,500.00. Price without instruments $2,000.00. Standard Aerial Surveys, Inc. 54 Park Place, Newark, N.J.

Used Planes—General

(See Index on page opposite)
(See also Group Classifications)

SAVOIA Amphibian $1,100. J-5 Stinson (recondition new) $1,000. Kinner Kittyhawk $700. Challenger Robin $825. Moth $680. Monocoupe $425. Kinner Bird $575. Commandaire $385. Waco "F" $1,295. Late Warner Traveler sport $1,300. Exhibition Parachute $100. To buy, sell, trade or refinance write, wire, Pioneer Aviation Airport Syracuse, N.Y. (T) No. 1

Bennett Air Service offers Cubs all models. Also Aeroncas, Taylorcraft and 22 other used planes. Lowest prices. All financeable. Free instruction to purchaser. "Cubtown", Hightstown, N.J. No. 2

Engines & Parts

See also ads marked (P) in group Classifications

FREE AEROPLANE with motor purchase. Easy terms $12.50 down. 200 pounds useful load. Welded steel construction. Propeller—all types—98c up. Sensational values. Illustrated information, and flying manual, 25c. Universal Aircraft, Fort Worth, Texas. No. 3

P. & W. Wasp C Airline engines, adapted for use with controllable propellers. $475 each. Frank Ambrose, Inc., Whitestone, Long Island, New York. No. 4

WRIGHT J6-5, 165 H.P., Ranger, 150 H.P., Wright J6-9, 330 H.P. Lambert 90, late type complete with ignition harness and shielded spark plugs. All motors have less than 330 hours total time with no time since major. Snyder Aircraft Corporation, Municipal Airport, Chicago. No. 5

Equipment & Products

Aeronautical Radio

Slightly used R.C.A. Radio Compass. Perfect condition, cheap. Will accept small two band receiver in trade. FS 508, Aviation, 330 W. 42nd St., New York City (T) No. 6

Aircraft Batteries

EXIDE 6-8 Volt $4.50. Flightex Fabric $.38 yard—Thinner $.85. Dope $1.10. Tail wheels Cubs, Aeroncas, etc. $18.00 list. Aeronautical Trading Co., Floyd Bennett Field, Brooklyn, New York. No. 7

Camera

We have for sale several Aerial Mapping Cameras, Fairchild F-4 with 12" or an 8¼" focal length cone. We also have some K-3's and 5-3-B's. Complete details will be given to interested parties. Wallace Aerial Surveys, 163 S. Howard St., Spokane, Washington. No. 8

Compass

KOLLSMAN AVIGATION COMPASS: Condition equal to new. Being checked by Airline Instrument Station. $40.00. Aerial Surveys of Pittsburgh, Mayran Avenue, Pittsburgh, Pennsylvania. No. 9

Services & Instruction

Book

New Examination tests in all grades fully covered with questions and answers. Order "Aeronautical Training" (Just revised) today. $2.00 postpaid or C.O.D. Quiz System, 1435 Flower St., Glendale, Calif. No. 10

Instrument Training

New Jersey's oldest flying school offers complete instrument flight training in 100 and 250 h.p. ships. Reasonable rates. Unger Aircraft, Inc., Hadley Field, New Brunswick, New Jersey No. 11

Wanted

Wanted instruments, Sperry Gyro Horizon Turn and Bank indicators, Rate of Climbs, Sensitive Altimeters, and Compasses. W 502, Aviation, 520 N. Michigan Avenue, Chicago, Ill.

USED PARACHUTES. Liberal allowance for your old chutes but they must be airworthy. Joe Crane, Irvin Air Chute Distributor, Roosevelt Field, Mineola, L.I., N.Y.

Employment

Positions Wanted

FOREMAN. Thirteen years experience in aircraft sheet metal work of all kinds, desires connection with progressive company. U.S. citizen. Age 32. PW 507, Aviation, 330 West 42nd St., New York City

YOUNG MAN, 22 desires parachute jumping, return flying instruction. Knows shorthand, typing. Free to travel. PW 510, Aviation, 330 West 42nd St., New York City

AERONAUTICAL ENGINE DESIGNER with broad experience along experimental and research lines. Good executive. Now employed. PW 511, Aviation, 330 West 42nd St., New York City

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WAR DEPARTMENT, Materiel Division, Air Corps, Wright Field, Dayton, Ohio. Office of the Contracting Officer.—The War Department invites the submission in competition of sealed bids covering airplanes under conditions set forth more particularly in the following advertisements: Circular Proposal No. 39-935 dated March 21, 1939, Airplanes, Training (Primary), described in Air Corps Specification No. R-707 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time, July 7, 1939. Circular Proposal No. 39-949 dated March 11, 1939, Airplanes, Bombardment, (Two-Engine) described in Air Corps Specification No. C-213 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time July 5, 1939. Circular Proposal No. 39-645, dated March 11, 1939, Airplanes, Bombardment (Four-Engine) described in Air Corps Specification No. C-212 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time, July 5, 1939. Circular Proposal No. 39-736 dated March 11, 1939, Airplanes Training, (Basic) described in Air Corps Specification No. R-709 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time July 7, 1939. Circular Proposal No. 39-760 dated March 11, 1939, Airplanes, Training, (Advanced) described in Air Corps Specification No. C-992 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time, July 5, 1939. Circular Proposal No. 39-779 dated March 11, 1939, Airplanes Interceptor Pursuit, (Single Engine) described in Air Corps Specification No. C-615 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time July 5, 1939. Circular Proposal No. 39-775 dated March 11, 1939, Airplanes, Twin Engine, Interceptor Pursuit described in Air Corps Specification No. C-616 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time July 5, 1939. Circular Proposal No. 39-780 dated March 11, 1939, Airplanes, Multiplace Fighter, described in Air Corps Specification No. C-618 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time July 5, 1939. Circular Proposal No. 39-786 dated March 11, 1939, Airplanes Observation Corps and Division described in Air Corps Specification No. C-414 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time, July 5, 1939. Circular Proposal No. 39-800 dated March 11, 1939, Airplanes Training Light described in Air Corps Specification No. R-793 dated October 15, 1938, bids to be submitted to the Contracting Officer not later than 1:00 P.M. Eastern Standard Time July 5, 1939. Full particulars with respect to said advertisements may be obtained upon application to the Contracting Officer, Wright Field, Dayton, Ohio. (0)

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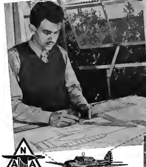

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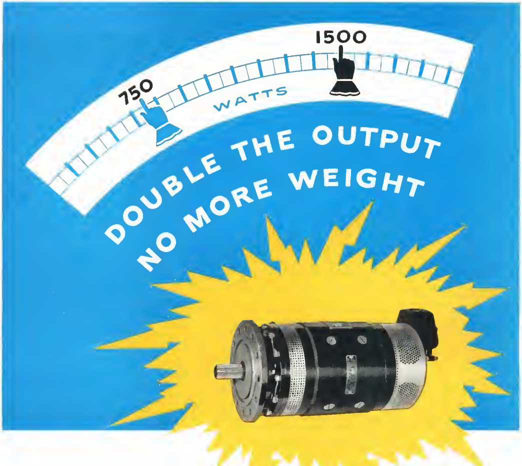

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